THE

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THE

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ELECTRIC SUPPLY UNDERTAKERS AND THE LAW OF NEGLIGENCE.

THE case of Midwood *v.* the Mayor, &c., of Manchester, the result of which we recorded in our issue of last week, merits something more than passing notice. It raises in a very interesting manner, the whole question as to the legal liability of electric supply undertakers when a charge of negligence is preferred against them; for although it is true that the defendants were a local authority, and that the decision of the case turned upon the construction of certain sections in their own provisional order, yet the decision is of universal application, inasmuch as the clauses under review are now to be found in the Electric Lighting (Clauses) Act, 1899, which applies to nearly every company and local authority supplying electricity.

The decision of the Master of the Rolls emphasises the fact to which we have adverted on more than one occasion, that electric supply companies are in scarcely any better position as regards the law of negligence than if they supplied electricity otherwise than in accordance with the provisions of an Act of Parliament. It is true that in constructing their works and in laying their cables, they are afforded a certain meed of protection; but in the giving of a supply, and in taking steps to secure the maintenance of pressure in their mains, the case under notice illustrates the proposition that they may claim no protection.

It is of interest to inquire into the present state of the law of nuisance and negligence in so far as it affects electric supply undertakers. The law of nuisance may be said to be settled, but it is by no means in a satisfactory condition. By Sec. 10 of the Electric Lighting Act, 1882, undertakers may, subject to the provisions and restrictions of the Act, and of any rules made by the Board in pursuance thereof, construct such works, and generally do all such acts and things as may be necessary and incidental to such supply. The effect of this section was to protect a company whose works occasioned a nuisance. So where a tramway company acting under a provisional order and using the best-known system of electric traction, caused electrical disturbance in the wires of a telephone company acting under licence from the Postmaster-General, it was held that the tramway company was protected from liability for nuisance (National Telephone Co. *v.* Baker (1893) 2 Ch. 186). Since this case was decided it became the practice to insert the following clause in provisional orders, and, indeed, it has been inserted in the schedule to the Electric Lighting Clauses Act, 1899:—"Nothing in this order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance caused by them." It was under this clause (together with another to which we shall presently refer) that the Manchester Corporation was held liable.

The effect of the clause was well illustrated by the case of Shelfer *v.* the City of London Electric Lighting Co. (1895), 1 Ch. 287. There an electric lighting company had erected powerful engines and other works on land near a house which was subject to a lease. Owing to excavations for the foundations of the engines and to vibration and noise from the working of them, structural injury was caused to the house, and annoyance and discomfort to the lessee. The lessee and the reversioners brought separate actions against the company for an injunction and damages in respect of the nuisance and injury thus occasioned. Mr. Justice Kekewich, after finding on the evidence that the defendants had created a continuing nuisance as regards the lessee and had caused structural injury to the house, held that both the lessee and the reversioners were entitled to relief, but under the circumstances by way of damages and not of injunction.

The plaintiffs in both actions appealed against the refusal of the injunction, and the Court of Appeal held that there was nothing in either case to justify the Court in refusing to aid by injunction the legal rights which had been established, and that the appeal must be allowed.

When the above case reached the House of Lords, Lord Halsbury said :—

> The nuisance being established, it is said, first, that the defendant company were authorised by law to carry on their business, and that as they have done all that skill and care can effect to prevent any nuisance, they are in the same position as a railway company, and are entitled to do what they have done under the authority of the Legislature. If the analogy were a correct one, I should think the defendants had fallen very far short in their proof that they had done all that was possible to prevent a nuisance. A railway company has a definite line of operation within which it may make its works, and, if it does all that can be done to prevent a nuisance in that place, the things having to be done in that place, and by locomotive engines with the necessity for fire being carried along the railway, the Legislature is taken to have sanctioned that proceeding. No such considerations apply here.

This decision was followed in a number of subsequent cases, and is still good law ; but it has been the subject of adverse criticism on the part of a Joint Committee of both Houses, which was presided over by Lord Cross in 1898.

It will be noticed that the foregoing considerations relate only to the establishment of a generating station ; so far as the laying of cables and the construction of other necessary works is concerned, it is clear that electrical undertakers are under serious liabilities in respect of nuisance.

Coming now to the question of negligence, it is provided by the Electric Lighting (Clauses) Act, 1899, (Schedule Clause 77) that undertakers shall be answerable for all accidents, damages and injuries happening through the act or default of the undertakers, or of any person in their employment by reason of, or in consequence of, any of the undertakers' works, and shall save harmless all authorities, bodies and persons by whom any street is repairable, and all other authorities, companies and bodies collectively and individually, and their officers and servants from all damages and costs in respect of those accidents, damages and injuries. So far as we are aware there have been no decisions bearing directly upon the construction of this section, but it is clear that to make the undertakers liable in accordance with its provisions, the plaintiffs must prove negligence.

Take, for instance, the case of a person injured by the explosion of a street box. For him to recover damages against the undertakers whose mains ran through the box, it would not suffice to prove that the accident happened ; he would have to go further and prove that the accident happened owing to some negligence on the part of the company, such, for instance, as negligence in allowing a short-circuit. There must be some "act" or "default" on the part of the undertakers before they can be fixed with responsibility.

In the case of Midwood *v.* Manchester Corporation, the jury were satisfied that there was some negligence, otherwise there could have been no liability except on the ground of nuisance.

Potential Regulators.

In the *Electrical World and Engineer* (New York) of July 1st, Messrs. A. E. Kennelly and S. E. Whiting describe a novel method of working a sensitive relay for regulating the potential of a circuit. The novelty consists in taking advantage of the change of resistance taking place in carbon and tantalum incandescent lamps with change of terminal voltage. Whereas the hot resistance of a carbon filament is about one half that of its resistance cold, the resistance of a tantalum filament hot is about six times its cold resistance.

The first method suggested by Messrs. Kennelly and Whiting is to arrange the carbon and tantalum lamps in the form of a Wheatstone bridge. Two arms of the bridge are composed of carbon lamps and the other two of tantalum lamps. The voltage of the circuit to be regulated is applied where ordinarily the connections to a battery would be made, and a polarised relay of ordinary construction takes the place of a galvanometer. The resistance of the lamps must be such that at normal voltage no current passes through the relay. On a rise of voltage occurring, the resistance of two arms of the bridge will increase and that of the other two arms decrease, thus sending a small current through the relay and causing it to close a circuit which will put in motion the necessary mechanism to bring back the voltage to normal in any of the many ways that are already well known. On a decrease of voltage occurring, a current is sent through the relay in the opposite direction, which will cause it to make a second contact and set in motion the mechanism required to increase the voltage to normal.

A second method suggested and tried by Messrs. Kennelly and Whiting is as follows :—The carbon and tantalum lamps are connected in series with the two windings respectively of a differentially wound relay, and are then connected across the circuit to be regulated. At normal voltage the currents in each winding of the relay are equal. On the voltage rising, the current through the carbon lamps increases at a greater rate than that through the tantalum lamps, and the relay comes into action. On the voltage falling below normal the reverse takes place.

Employing a Western Union polarised relay, as used in duplex telegraphy, and with three 120-volt 16-c.p. carbon lamps in series in one circuit and six 110-volt 25-c.p. tantalum lamps in series in the second circuit, Messrs. Kennelly and Whiting obtained a voltage regulation of $\frac{1}{2}$ per cent., that is, $\frac{1}{4}$ per cent. each side of the mean.

It is obvious that in employing these arrangements it is necessary, in order that the greatest sensitiveness may be obtained, that both the carbon and tantalum lamps shall be worked at that temperature which will give the greatest rate of change in resistance with variation of terminal voltage.

The British Association in South Africa.

In the *Times* for July 24th there appeared a lengthy forecast of the meeting of the British Association for the Advancement of Science, which opens at Cape Town on August 15th. A number of those taking part in the visit embarked a week ago, and others are to leave Southampton to-morrow. Altogether it is estimated that about 400 members and guests from this country will

be present at the meetings, while there will also be a large attendance of the members of the South African Association for the Advancement of Science, and a large number of local associates. It is estimated that from start to finish the visit will occupy about 70 days, one-half of this time being required for the voyages to and from the Cape. The first half of Prof. G. H. Darwin's presidential address will be delivered at Cape Town on August 15th, and it will be concluded at Johannesburg on August 28th. From an electrical point of view, the gatherings will not be of commanding interest. The papers, which are announced in the article referred to as coming under the consideration of Section A, include the following :—"To what extent can the Ether effect the Motion of Matter?" by Prof. Larmor ; "Radiation at Low Temperatures," by Dr. J. T. Bottomley ; "The Leak of Electricity from Certain Heated Substances," by Prof. Beattie ; "Observations of Atmospheric Electricity in South Africa," by Prof. Beattie and Mr. Lyle ; "The Strength of Winding Ropes in Mines," by Prof. Perry ; "Magnetic Survey of South Africa" and "Electrical Conductivity in Relation to Chemical Action," by Prof. Beattie ; "On Flight," by Prof. G. H. Bryan ; "Form of Dry Daniell Cell," by Mr. J. Brown ; "The Experimental Foundations of the Theory of Heat Conduction," by Dr. C. H. Lees. The Mathematical and Educational Sections will jointly discuss "The Teaching of Elementary Mathematics," Prof. Perry contributing a paper on "The Teaching of Elementary Mechanics." The Engineering Section will have as its president Sir Colin Scott Moncrieff, whose discourse will be devoted to irrigation. Papers are expected on roller bearings, wire ropes in mines, and probably automobiles, but the section does not promise to be an exciting one for electrical engineers. The evening lectures include one by Prof. W. E. Ayrton on "Distribution of Power," one on "Diamonds," by Sir Wm. Crookes, and one on "The Bearing of Engineering on Mining," by Prof. Porter, of McGill University, Montreal.

Limits of Municipal Activity.

In these days of immensity it is well to remember vulgar aphorisms, even when these are tinged with the crudities of American slang. We would commend to the London County Council the advice—which is redolent of the Mississippi days of Mr. S. L. Clemens—anent biting off more than can be chewed. The action of the Council and its spokesmen in the House of Commons in regard to the Administrative County of London Co.'s Power Bill is extremely unsatisfactory to many who are normally associated with the Progressive cause in municipal politics. Primarily, the councillors should be the watch-dogs of the citizens, and there is little doubt that the purity and zealousness of their administration have, on the whole, made for efficiency and the common weal. Even good watch-dogs are apt to bay at the moon, and the policy of opposing large power Bills because the County Council has not a cut-and-dried policy ready to hand seems a questionable proceeding, apt to exasperate the nervous ratepayer in much the same manner that the howling of a dog, without reasonable cause, vexes both its owners and the neighbourhood. The present majority on the Council should remember that in Nature there is such a phenomenon as saturation. The absorptive capacity of a sponge is a very fair parallel case. When dry, its pores readily suck up water from the basin in which it is placed ; but after a while no more can be retained. As regards municipal activities, the London County Council has surely reached a point of saturation. To go beyond the saturation point in the magnetising of a bar of iron means that a greater flux can be secured only by the expenditure of a magnetising force out of all proportion to the result attained. To go beyond the legitimate sphere of municipal activity, to attempt to control more than can be conveniently managed, is merely to promote an ultimate all-round inefficiency. When one remembers that the London County Council is responsible for main drainage, the fire brigade, parks and open spaces, an elaborate tramway system, the inspection of theatres, a fleet of steam boats, the inspection of weights and measures, workmen's dwellings, the control of certain asylums, and the drafting of building regulations, and has its delegates upon the Water Board and the Thames Conservancy Board, it is manifest that in these spheres alone there is an enormous responsibility. When it is remembered that the recent Education Act has thrown the whole of the School Board system, together with the denominational schools, upon the County Council, it is surprising, nay, astounding, that its members should seek to add to their labours. To attempt to assimilate more than an organisation can comfortably deal with, is folly in its extremest form ; to attempt to proceed beyond the point of saturation is to travel in the face of all natural laws and to waste energy prodigiously and prodigally.

Certain advocates of the advanced municipal school would say in effect that the Council works through its several Committees, who exercise a directive influence over their permanent officials, and that these permanent officials are the best that can be obtained by the offer of high salaries and the prestige of serving the greatest city in the world in an important capacity. All this may be true, yet it is an undoubted fact that management (or supervision) by a Committee cannot produce the same economy that can be secured by a board of directors of business men, having large personal interests at stake. In a well-organised private business undertaking, the gearing must work more smoothly, there must be more efficient control throughout the various departments than can possibly be the case with a committee, no matter how able its individual members may be. A sense of lack of continuity, realised or unrealised, cannot but permeate the middle and lower grades of a municipally directed scheme, when it is remembered that the members of the supervising committee are subject to the caprices of the electorate, and that by reason of popular indignation against the members of Committee No. 1, the members of Committee No. 6 may be rejected at the polls, although the operations of Committee No. 6 may have been as perfect as if they had been controlled by omniscient archangels.

Humanity has not yet evolved the omniscient archangel type of administrator. The shoemaker who may be *sans reproche* at his last, would scarcely be in his place on a Lunacy Committee, or on the directorate of the Bank of England. It is surely better that a public body should proceed to do better in the spheres in which it has already done well, in preference to taking over duties best performed by individual enterprise. To do well administratively in a few things is a better policy than that of running the risk of doing badly all round because the tasks are too great. To guard the community against excessive charge by securing sliding scales, and to provide for an equitable system of purchase a half-century or so hence, in case the public representatives at that date should wish to acquire the business, is all that is required of the London County Council in connection with the Electric Power Bills. To do more is to bite off more than the municipal jaws can masticate.

Edison Incandescent Lamp Manufacture.—In the journal of the Franklin Institute for July, there is published a paper by Mr. J. T. Marshall (who has been continuously in the employ of the Edison and allied companies since 1881), in which an excellent account of the evolution of the modern Edison lamp is given. In 1881 there were made in the United States 34,000 very crude-looking lamps, taking 5·8 watts per candle, lasting 3,000 hours (with a great decline in candle-power), and selling at 2s. 8½d.—less than half their cost price. Last year, on the other hand, 45 million Edison lamps were made in the States, of artistic appearance, taking 3·1 watts per candle, and lasting 800 hours, with very much better maintenance of candle-power than the old ones, while the selling price was only 8d. The author compares the essential features of the 1881 and 1905 lamps, and it is interesting to follow each process through its various stages of development ; almost the only operation which has not suffered improvement is that of soldering the wire to the brass cap. The use of red phosphorus in conjunction with mechanical pumps to produce a high vacuum was a notable advance over the mercury pumps. It is a pity that users here cannot be educated to understand that a 3-watt lamp, though shorter lived, is far more economical than the 4-watt lamps that we find in general use at 100 volts ; or a 4-watt lamp at 200 volts than the 5-watt lamps with which the market is flooded.

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THE GALBRAITH ELECTRIC FURNACE.

We made a brief reference in our last week's issue to the demonstration of the Galbraith process which took place at the works of the Brush Electrical Engineering Co., Loughborough, on July 19th, in the presence of representatives of the steel industry, the technical Press, and others chiefly interested in electro-metallurgical progress, or in the industrial development of New Zealand. We must, at the outset, confess to having some difficulty in understanding what object the Galbraith Co. could have had in view when they decided to go to the expense and trouble of organising a semi-public demonstration of a process which, however interesting or promising, has obviously not yet emerged from the laboratory stage. The purpose of a public or semi-public demonstration to which the Press is invited is, one would think, the very legitimate one of trying to convince first the technical world, and finally the investing public, of the commercial value and the future possibilities of the process, with a view to its further development and ultimate application to the problem it presumes to solve. We regret that with all the goodwill in the world it is impossible for us to look upon the Galbraith furnace as in any way, at least in its present form, a commercial solution of the problem of smelting New Zealand ironsands. Even the inventors seem to have an uneasy feeling that they have up to now taken only the first step forward towards the successful realisation of their hopes, for Mr. W. Steuart—the courteous representative of the company who was in charge of the demonstration—was most careful to point out that the *efficiency*, that is, in other words, the commercial practicability of the process as shown, was not to be considered; all that the inventors wished to demonstrate was the *possibility* of doing what, up to the present, no one had ever succeeded in doing, namely, the production of steel direct from titanic ironsand.

So disappointing, indeed, was the Loughborough demonstration, that we would not have thought it at all necessary to describe and criticise the process at any length, did we not believe that the inventors are after all on the right track, for there can be little doubt that one must look to the electric furnace finally to solve this ironsand problem, and the inventors do, moreover, seem to have grasped—perhaps in a somewhat halting fashion—the fundamental principles underlying the application of the electric furnace to the smelting of steel.

The treatment of the famous ironsands found on the seashore in the province of Taranaki, New Zealand, is a problem which has long engaged the attention of metallurgists, and since 1884 numerous attempts have been made to smelt these deposits, large sums of money having been sunk in the efforts, but hitherto without success. The ironsands, which have been ground by the action of the sea into finely-divided particles of remarkable uniformity, consist chiefly of magnetic oxide of iron, the iron content often reaching 70 per cent., or over. The amount of impurities is extremely small, sulphur and phosphorus—the undesirable impurities—being, as a rule, present only in the merest traces, but titanium is present as titanic oxide in quantities varying from about 1 to 4 per cent. The sands are in too finely-divided a state to be smelted in the blast furnace in the ordinary way, and briquetting, which has been tried with some measure of success, has not, up to the present, yielded really satisfactory results, on account of the tendency which the briquettes have to fly, before reaching the zone of fusion of the blast furnace. A further difficulty in the way of smelting these ironsands is caused by the presence of the titanium, which prevents the slag from becoming properly fluid. The advent of the electric furnace as a practicable medium for the smelting of iron and steel has now put a somewhat different complexion on the possibilities of commercially tackling the ironsand problem, and the inventors of the Galbraith process are to be congratulated on having grasped the opportunity thus offered to them, by abandoning the beaten track, and working on lines which there are strong reasons for believing must ultimately lead to success.

The Galbraith furnace is of the electro-thermic type; the electric current is merely used as a substitute for fuel in supplying the necessary heat for the smelting of the ore and the melting of the product. It consists essentially of a space which is rendered incandescent by the radiation from a series of graphite or carbon bars brought to a bright red heat by the electric current, which is passed through them in parallel. Through the incandescent space is fed a suitable mixture of the ironsand and powdered coke; reduction of the iron oxide at once takes place, and as the reduced particles gradually fall through the furnace, they coalesce together to form larger globules, and thus fall into the heated well at the bottom of the furnace, whence the product may be tapped in the fluid state. The ironsand is first concentrated magnetically; as it consists so largely of the magnetic oxide, this is a very simple and cheap operation. The furnace shown at Loughborough contains ten horizontal rows of graphite "incandescents," each being practically a grid made up of four bars and five bars in the alternate rows. These bars are diamond-shaped in section, and are about $2\frac{1}{2}$ in. broad and 6 in. long; they were made by the Morgan Crucible Co. The four-bar grids were supposed to carry about 800 amperes and the five-bar grids 1,000 amperes, but they were actually taking less current than this, about 5,000 amperes in all, since a 100-KW. transformer was supplying current to the furnace at 18 volts. Connections were made by means of iron slabs pressed hard up against the machined edges of the graphite cross-bars at each side of the grids; presumably this is not the type of connection intended to be used in practice.

These "incandescents," or carbon bars, are one of the weak, or, at least, one of the "unknown quantities" of the furnace. At present made from graphite, it is intended ultimately to make them from gas carbon, but it is absolutely necessary that they should be perfectly uniform and homogeneous, otherwise local heating will occur in the furnace, and the temperature conditions generally will be impossible of adjustment. What their depreciation is likely to be it is impossible to say, for absolutely no experience at all is at present available, the furnace having only been in operation for short runs of a few hours' duration. It is true that oxidation can be prevented by keeping an atmosphere of carbon monoxide inside the furnace, but the continual wear and tear caused by the falling charge must, one would think, produce in time a very appreciable amount of abrasion; only prolonged experience can decide how much.

The maximum capacity of this 100-KW. furnace was stated to be 18-19 oz. of ironsand per minute, or 280 tons per annum working continuously, but on account of the furnace having become choked during the run, far less charge than that equivalent to this rate was fed in during the demonstration, and the three or four hours during which the furnace was in operation yielded only a few pounds of white pig in all. Assuming, however, that the maximum rate of feed could be maintained, the efficiency of the furnace works out at about 0·36 E.H.P.-year per ton of ironsand, or assuming a 70 per cent. charge, 0·51 E.H.P.-year per ton of product. No attempts were made, in the furnace as shown working, to conserve the heat evolved; the inventors, however, state that under proper working conditions a 100-KW. furnace could treat over 5 lb. of ironsand per minute, equivalent to an efficiency of about 0·10 E.H.P.-year per ton of product. Whether this figure could or could not be reached in practice is, of course, a matter of pure conjecture; as it was, not even the lower efficiency of 0·51 E.H.P.-year was anything like attained. If we suppose, with the inventors, that the lower figure will eventually be reached, the furnace will absorb almost exactly the same amount of power as the 450-H.P. Héroult furnace at La Praz, or the 300-H.P. Kjellin furnace at Gysinge. Leaving, for the moment, the question as to the cost of the energy for operating the furnace, there are a few remarks to make regarding the product yielded by the Galbraith process. It is claimed that the aim of the furnace is to produce steel direct from the ironsand, although considerable doubt seems to exist in the minds of the inventors as to whether the metal tapped from the well of the furnace will be steel or not. Certainly the

product hitherto obtained with a 2 per cent. carbon content can hardly be classed as steel. In their pamphlet, the inventors speak of decarburising by iron oxide, or "Bessemerising" the initial product, but during the demonstration the opinion was expressed that by suitably adjusting the composition of the charge and, generally, the conditions under which the furnace is working, it will be possible to cause the furnace to yield a steel with any desired carbon content. At present, however, the possibility of effecting this is mere conjecture, and so much depends upon it, that it is idle to assume it can be done when up to the present it does not appear ever to have been attempted. Adjustments of this delicate nature in metallurgical operations are not, by any means, foregone conclusions, and no claim in this direction can be considered as valid that cannot satisfy the test of experimental proof. If, on the other hand, "Bessemerising" has to be resorted to, the process is merely one for the manufacture of pig-iron, and not, as claimed, for the production of steel direct from the ironsands. There remains the method of decarburisation, but if this is to be the method of procedure, and it is our opinion that the process will ultimately so resolve itself, the whole intermediate portion of the furnace, the "incandescent" space, with its carbon or graphite resistances, must disappear. It is a well recognised fact that the temperature of the electric furnace is unnecessarily high for the actual reduction of iron ores. Moreover, in the present case, it is not the reduction *per se* that causes the treatment of ironsands to be so troublesome, but the difficulty of getting the reduced metal to melt and flow together into a homogeneous fluid. The inventors of the Galbraith process apparently realise this fact, because it was mentioned that probably in practice reduction would take place in an external furnace using producer gas as the reducing agent. This is admirable, but what it means is that all that is wanted is a satisfactory melting furnace in which to melt the particles of reduced ironsand, and convert them into steel of any required grade. Now such a furnace, in an ideal form for this class of work, already exists in the Kjellin furnace which, as already stated, has even now reached an efficiency of 0·12 E.H.P.-year per ton of steel. The Kjellin is an induction furnace in which the molten charge forms the secondary of what is practically a step-down transformer. The steel is thus melted without coming into contact with either electrodes, air, or furnace gases, and this is, therefore, almost an ideal form of electric crucible furnace. Molten pig-iron is charged into the circular hearth to start the furnace, and from that moment the furnace works continuously, and is under perfect control. It does not, of course, eliminate impurities, but in the case of the ironsands there are no impurities to eliminate, nothing but a possible excess of carbon to get rid of, and this can be brought about either by the slight amount of oxidation that goes on in the furnace, or by adding to the charge a certain proportion of iron oxide.

It is into a melting furnace something like the Kjellin—although not necessarily heated inductively—that we believe the Galbraith furnace must eventually develop, if it is to tackle with any hope of success the problem the inventors have laid themselves out to solve. The furnace, even in its present form, requires the addition of some means for heating the well at the bottom in which the product is collected and from which it is tapped, and doubtless electric heating is the means contemplated for bringing this about. If, in addition, the ore is reduced outside the furnace, no purpose is served by retaining the Galbraith furnace in its present form, and the unnecessary incandescent bars—we are fully aware of the dangers of prophecy!—must, as we have said, disappear.

And now a few words as to costs. Will a perfected form of electric furnace be able to make steel in New Zealand that can compete with the imported products of the Bessemer and Siemens furnaces? It is clearly nothing but a question of the cost of power. Mr. Harbord tells us, and his opinion has been generally confirmed by other metallurgists, that even pig-iron can be produced on a commercial scale at a price to compete with the blast furnace when electric energy can be had for about 42s. per E.H.P.-year. We are unable to state here the total amount of water-power that will in time be available in New Zealand for the production of electrical energy, but it was stated at Loughborough that the Galbraith Co. will be able to have at their disposal the energy of two 10,000-H.P. water-falls at a cost of about 40s. per H.P.-year, or 53s. per E.H.P.-year. This, to be sure, is equivalent to only 0·07d. per unit, but in Norway and Canada large quantities of water-power are available for only 30s. per E.H.P.-year, and there is, therefore, no substantial reason to doubt that New Zealand can produce electrical energy at the figure stated. If she can do so, she will certainly be in a position to manufacture electrically all the steel she wants for her own requirements, without having to import from the Old Country, at freights of 30s. a ton or more; for a furnace absorbing only 0·12 E.H.P.-year per ton will make steel at the rate of 6s. 4d. per ton, excluding the costs of raw material, labour and other charges, and 20,000 H.P. will enable New Zealand to produce 125,000 tons of steel per annum, a number far in excess of her present requirements.

ELECTRICITY IN SUBMARINE MINING.

The almost indiscriminate use of mines in naval warfare, as practised by the two belligerents in the Far East, has gone far to illustrate the practicability of modern methods of exploding them, and not the least significant fact brought to light is the unsuitability of electricity where it can be avoided. The chief reason for this is liability to deterioration in the Leclanché cell, which even on open circuit is apt to run down in consequence of leakage.

Those who are accustomed to associate the Leclanché cell with the common house system of bell circuits will hardly realise this liability to deterioration, but it must be borne in mind that the conditions under which the cell has to carry out its functions are very different.

In the ordinary house circuit the wires are under cover and protected from damp, and even where they are exposed to the weather, they have the advantage of evaporation for drying purposes. Thus it is that the insulation is so perfect that leakage is practically a negligible quantity. It is very different in submarine mining.

To begin with, the type of cell used in the Navy is of very low resistance; in the ordinary "boat's battery" type which we have in mind, it is about two-tenths of an ohm, and therefore capable of giving a comparatively large current.

The cells are either made up into large batteries of about 80 cells, for use in controlling the mines from a shore station, or are placed in the mine itself, a pair to a mine; in the latter case the mines are self-contained, and are known as "electro-mechanical" mines. The circuit has only one break, known as the circuit closer, and is otherwise completed through the detonators.

The circuit closer is a form of mercury contact which acts when the mine is bumped. Now, when a mine has been laid out for some time, the interior of it, even supposing there to be no leakage of water through the joints, gets very damp, the iron case sweats a good deal, there is a certain amount of leakage, therefore, across the terminals of the battery, and this is assisted by the slight creeping of sal-ammoniac, which, in spite of precautions, almost invariably takes place to some extent.

This creeping may, perhaps, be in a large measure caused by the tidal and wave motion to which the mine is subjected, causing the liquid to wash about and leave deposits above its normal level; the Japanese have, it seems, rather successfully used dry cells in spite of their liability to deterioration, and here we may, perhaps, digress for a space, to give our experience of the deterioration of dry cells stored under naval conditions. These cells, when their internal resistance has gone above a certain standard, are broken up as old zinc, and it is almost invariably found that the cause may be traced to local action in the zinc eating it away and covering it with scale.

From whatever cause it may be, however, experience has shown that batteries used inside a mine deteriorate quickly, and are, therefore, unreliable after a certain length of time.

Batteries used outside a mine and on a circuit to be closed by a mechanical device inside it, run down through leaks in the submarine cable. The circuit here is invariably "earthed" through the steel armouring and so back through the sea water, and consequently the minutest leak soon develops.

It would appear, therefore, that electricity for automatic mines is doomed, and that its place will be taken by some purely mechanical device which will become released when the mine is struck, like the "horned" mines of the Russians; it is a pity that it should be so, for such mines, breaking adrift as many have done in the China Sea, become a lasting danger to shipping until they have been destroyed.

While speaking of mines and the application of electricity to them, it is curious to note that there have been proposals to fit them with zinc plugs, which, by galvanic action, eventually become eaten away and drown the explosive, sinking the mine, and thus putting it out of action.

PARLIAMENTARY.

The Administrative County of London and District Electric Power Bill.

Tuesday, July 18th.

At the outset of the proceedings, the Chairman asked if the proposed purchase clause had been communicated to the Board of Trade.

The Hon. J. D. Fitzgerald said that it had not.

The Chairman: I think that should be done.

Mr. Fitzgerald: Very well, Sir; a copy shall be sent.

Sir Ralph Littler, K.C., asked that he should have an opportunity of cross-examining Mr. Merz on the purchase clause later on. So far as there was cross-examination, it had, perhaps, more to do with the executive of the company than with the engineer, but he might wish to cross-examine Mr. Merz on some of the details.

The Hon. J. D. Fitzgerald said that he could see no objection, although he thought that there was very little that the engineer could speak to.

Mr. Merz was then cross-examined by Mr. Ralph Neville, K.C., on behalf of the Westminster Co.

Witness would not admit that the conditions on which he had calculated the figure of 8·3 per unit were not conditions which would actually be found in practice. He had not calculated the figure on 100 per cent.; it was calculated on 33 per cent.

Mr. Neville: It is calculated that during the 8 hours the maximum load will be in operation?

Witness: We don't say that the man runs his works only 8 hours a day; that is the average.

Mr. Neville: I don't see anything about maximum demand; only 8 hours a day. That table affords no clue as to what an ordinary manufacturer would pay who runs his works 56 hours per week?

Witness: No. We should require to know what his load factor was.

Mr. Neville: Then it does not show the actual charge?

Witness: No, it does not. That would be impossible.

In reply to further questions, Witness said that they had estimated the sale of 33,500,000 units at ·7d., the load factor being 35 per cent.; 23,000,000 units would be for traction purposes. He did not think that ·7d. was an impossible price. It was not a high price for bulk. Of course the distributor would have to charge 2d. or 3d. The actual price to the consumer would depend upon the load factor. In Newcastle the average price to consumers was 3¾d., less discount. There was another rate at which only large users could be supplied, which worked out at 2½d.

Questioned as to the Central Supply Co. of the Westminster Co., Witness said that he was quite aware that provision had been made there for a large bulk supply. He thought that there were consumers in the Westminster Co.'s area which that company could not get on account of their high prices. No doubt the prices would be reduced in the future.

Further cross-examined, Witness said that where they approached a railway company for the purpose of supplying it with power for traction, they would, or course, supply for lighting purposes as well. There would, however, be a limit of 20 per cent. to be used for light in such a case.

Mr. Neville: A large factory would show a more uniform load than a small factory on account of the number of motors?

Witness: No, I object to making generalisations of that kind. It does not follow. A small factory might run its motors continuously.

Mr. Neville: Why have you dragged the Westminster area into your own area when the only people you can supply can either be supplied outside that area or else show no great demand for power?

Witness: Because we want to supply you.

Mr. Neville: Then what are you going to supply us with.

Witness: Electricity.

Mr. Neville: In bulk?

Witness: In bulk.

Mr. Neville: Do you mean as a standby?

Witness: We think we can supply you more cheaply than you can generate yourselves.

Mr. Neville: From your point of view are we to continue our generating stations, or are we to give them up?

Witness: I anticipate at present that your stations would be used to advantage for giving a separate supply.

Mr. Neville: Then we should be liable to pay you under Sec. 55?

Witness: Yes, if we enforced that.

Witness was then cross-examined by Mr. Erskine Pollock, on behalf of St. Pancras. He said that he had included St. Pancras in the industrial area, because it was a factory district.

Counsel proceeded to point out that a great part of St. Pancras was essentially residential in character, and that there were few factories.

A long cross-examination followed on the question of the price charged for power by St. Pancras.

Mr. Pollock said that the average charge for power since July, 1904, had been 1d.

Witness said that the supply was liable to be cut off.

Mr. Pollock: But it has never been cut off?

Witness: No.

Mr. Pollock said that the reason for the statement was that preference would always be given to the consumers of light rather than those who took power.

Witness could not agree with that "interpretation of the Act."

Mr. Pollock: There is no company competing with us at all.

Witness: No.

Mr. Pollock: And it has been a very successful undertaking?

Witness: Yes, I believe so.

Mr. Pollock: Then why do you wish to come in? Do you know anything about the factories in the district?

Witness: There is no reason why your undertaking should not be made more profitable.

Mr. Pollock: But we don't think your coming in will be of any value to us.

Witness: That is because you have not gone into the matter, so that your opinion is worth nothing.

Cross-examined by Mr. Macinerney (for Hackney), Witness admitted that the promoters could supply all the rest of their area if Hackney were omitted from the scheme.

A long cross-examination of Witness followed, in which counsel for Hackney attempted to show that the prices charged by the Borough Council were lower than those proposed to be charged by the promoters of the Bill. Mr. Macinerney also cross-examined on behalf of Stepney.

Mr. Macinerney caused some amusement by asking Witness whether he thought it was right for the promoters to have written to the Hackney Borough Council a letter in which that Council was referred to as having "joined the ring of opposition." Was that proper language to use to a Borough Council?

Witness made no reply, and counsel proceeded to say that "ring" was an American term, and was not applied to the victims, but to the vampires.

Mr. Morten then cross-examined witness on behalf of West Ham. Witness admitted that the existing station of the Borough Council which had a capacity of 18,000 kw. would be sufficient for the needs of the borough "for a very long time." The reason why the promoters wished to come into West Ham was that they thought they could supply power more cheaply.

Mr. Morten: Do you know that we are now supplying manufacturers with power at less than 1d. per unit?

Witness: I should think it very possible. He thought that the promoters would be able to "push" their supply better than the Borough Council were able to do. He knew of no reason why municipal authorities should not use the same business methods as private companies, but they had not done so up to the present.

Mr. Vesey Knox, on behalf of Southwark, asked that he should have an opportunity of seeing any agreement which had been arrived at between the promoters and the County of London Co.

The Hon. J. D. Fitzgerald said that the terms of such an agreement would, of course, be put before the Committee.

The Hon. C. A. Parsons was then called, and spoke as to the advantage of large-size turbines. He said that the price per horse-power decreased with the increase in size of the machine. The floor space occupied per horse-power was comparatively small, and did not increase in proportion as the power. The steam consumption per kilowatt in turbines of the size proposed to be used by the promoters would be about 15 lb. per hour.

In the course of cross-examination by Mr. Vesey Knox, witness said he knew that inventors were busy on the gas turbine, but he did not know what progress had been made. Counsel questioned Mr. Parsons as to the actual working results of two turbines which had been supplied by his firm to the St. Pancras Borough Council. In one case counsel alleged that, working at quarter load or 250 kw., the steam consumption was 6,800 lb. instead of 6,000 lb.

Witness said that the tests in question were merely preliminary tests.

Similar evidence was given by Mr. C. Brown, of Messrs. Brown, Boveri & Co. He thought that the amount of steam used in the larger size of turbines would be 40 per cent. less than in the smaller engines. The capital outlay for steam plant was very much less than that for water-driven turbines. He thought that the coal consumption per unit generated by turbines of the size proposed by the promoters would be under 2½ lb.

Mr. Merz was then recalled and cross-examined by Mr. Courthope Munroe, on behalf of Shoreditch. Witness did not know that 66 per cent. of the factories in Shoreditch were being supplied by the Borough Council; he thought it was extremely improbable.

In reply to learned Counsel for Battersea, Witness said that he was not aware that the South-Western Railway Co. had entered into a contract with the Council for taking a supply of power at 1d. per unit.

Wednesday, July 19th.

Mr. Merz, cross-examined by Mr. Blennerhassett, for the Westminster City Council, said that he was aware that in that City the company would supply the existing companies, and that the City Council had no electric undertaking of its own. There was no necessity for coming into Westminster to supply any railways or tramways. Docks and canals within the area were certainly negligible.

Mr. Blennerhassett: Then why do you take power to supply all such undertakings in the City? Are you willing to consider a proposal to strike them out of the Bill?

Witness could not say. In reply to further questions, he said that he did not think that the Westminster Co. would be able to supply so cheaply as the promoters, although they might put up a new station of a capacity sufficient to supply all the railways, tramways, &c., in the district.

Mr. Blennerhassett asked if the promoters would agree to a clause providing that no part of the ring main should come within the City of Westminster?

Mr. Merz said that he certainly could not agree to that.

Counsel for Westminster asked Witness if the promoters would agree to pay any expenses which the City Council might be involved in on account of the laying of the ring main. Would he be willing to have an arbitration instead of going to the Board of Trade.

Witness thought that sufficient protection was given by the Bill.

Replying to Mr. Vesey Knox, who appeared for a number of local authorities in the industrial area, Witness said that he could give no assurance that the promoters would not oppose any company which might in the future seek powers in their area.

Mr. Vesey Knox: You take power now to compete with the local authorities?

Witness: Yes, with leave of the Board of Trade.

Mr. Vesey Knox: And in the case of the Kent Co. that will give that company powers which they did not have in 1902.

Witness: No. I don't think we are seeking to give the Kent Co. any powers. The promoters would, of course, make business agreements with any authority, and would supply the Kent Co. in bulk.

Mr. Vesey Knox contended that that was practically helping the Kent Co. to compete with the local authorities.

Questioned as to Bexley, Mr. Merz said that the reason why the promoters proposed to charge so high a price as 1·35d. to the Bexley Council, was that when the company took over the Council's station they would have to pay interest and sinking fund upon that generating station, which the Council had already erected. That came to 1d. per unit, so that the price really charged to the Council would be only ·35d. per unit.

Mr. Vesey Knox: But you won't take over the station until two years' time?

Witness: That is so.

Mr. Vesey Knox asked why Chislehurst had been included in the industrial area, and Witness said that the area was based on a plan of the districts which it would be most economical to supply. He knew that places nearer London had been omitted from the scheme.

During a lengthy cross-examination on the position of the supply company at Newcastle, Mr. Vesey Knox drew witness's attention to the fact that while the Newcastle Co. had during its 13 years of existence obtained only 2,400 customers, the Ilford Council had in three years obtained 1,800 customers.

Witness thought that if that were so it only showed that the Ilford Council had conducted their business properly.

Cross-examining on behalf of Southwark, Mr. Vesey Knox asked Mr. Merz if he were aware that in all parts of that district there were already two competing companies; why, then, did the promoters wish to enter the district as well?

Mr. Merz said he could only give "the old answer."

By Mr. Bernard Wilkinson (for the Gas Light and Coke Co.): He would not go so far as to say that there would have been no need to go through Westminster except to get to the Fulham generating station. It was possible that the Fulham station would not be erected until the other two stations had full loads. It would probably be erected in 1911. The land on which the promoters propose to build their Fulham station was the property of the Gas Co., and counsel asked witness if he thought that the company would sell, as the effect of the station would be that a competition would be started with the gas power supplied by his clients.

Mr. Merz could not see that that would have anything to do with the sale of the land. The company would get a good price.

After the luncheon adjournment Mr. Balfour Browne, K.C., announced the effect of the agreement which had been come to between the promoters and the County of London Co. He said that the promoters had approached them, and that in future what would take place would be this: When the promoters got their system into proper working order, and three years was allowed for that purpose, the County of London Co. had agreed to take power from the promoters for any additional requirements beyond what they could supply for their present plant on terms to be agreed upon, or failing agreement, upon arbitration terms, the arbitrator to be appointed by the Board of Trade. The supply would be on a basis of a substantial reduction upon the cost at which the County Co. at present generated. The County Co. would undertake to adopt the prices scheduled by the Administrative Co., so that the consumer would at once get the benefit of cheap power. They were perfectly satisfied with this agreement, which they considered was also in the public interest. They no longer opposed the Bill, and, in fact, wished it to proceed.

Mr. Vesey Knox asked whether the Administrative Co. would compete for power in the County Co.'s area.

Mr. Balfour Browne said that they would not do so after three years.

The Hon. J. D. Fitzgerald, on behalf of the promoters, said that he could confirm the statement made by Mr. Balfour Browne. He handed a copy of the clause to the Committee.

Mr. Courthope Munroe said that the Camberwell Borough Council had powers of purchase over a certain part of the County of London Co.'s undertaking. He asked the Committee not to give any decision on the agreement until he had ascertained what effect the agreement would have upon the position of the Borough Council.

The Hon. J. D. Fitzgerald said that the purchasing powers were not affected at all.

Mr. Merz was then further cross-examined by Mr. Sanders (for Islington), and Mr. C. C. Hutchinson (for the Notting Hill Co.).

Mr. Hutchinson put it to Witness that the cost per mile of main as estimated by the promoters, was £1,000 per mile under what it should be.

Witness said that he was sorry that the person who gave counsel that figure did not know more of the subject.

If that were correct, it would make a difference of £400,000.—Yes.

Thursday, July 20th.

Mr. Merz was re-examined at some length by Mr. Honoratus Lloyd, K.C. As to the statement that had been made that the local authorities could combine and do what his company proposed to do, he pointed out that a conference of the local authorities was held in January last, when the question was discussed. The decision was in the negative. The promoters desired to be in the same position as the gas and dock companies in regard to the operations of the Building Act of 1894. It was not true, as had been suggested, that the majority of the promoters came from Newcastle, as a matter of fact, only 17 came from that part of the country, while 42 came from London. The reason why the promoters wished to have a long term in the purchase clause, was that they wished to have time to get their undertaking into proper working order, and that would probably take a few years.

The Chairman: You desire to have 50 years so as to attract subscribers?

Mr. Merz: Certainly.

Mr. S. Z. de Ferranti was then called. He said that he fully agreed with Mr. Merz's figures and estimates, having considered them carefully. To enable London to have a really cheap power supply adequate to its needs, it was absolutely necessary to obtain it from a central producing centre, such as was proposed by this scheme. Witness, at some considerable length, dealt with the advantage of the turbine over the ordinary reciprocating engine. Replying to a member of the Committee, he said that he did not see how the mains could possibly be a danger to the public. He agreed that the company could purchase the shares of the existing companies, but did not consider such a course probable.

Friday, July 21st.

Mr. Ferranti was cross-examined by Mr. Lewis Coward, K.C. (for the London County Council). He said that he interpreted the purchase clause as being a clause to fix the price of purchase—if the undertaking was to be purchased. There was no provision in it that the undertaking *should* be purchased.

Mr. Coward suggested to witness that the clause was contrary to the statement made by the promoters before the second reading. Had the clause in its present form been submitted, then the Bill would never have come before the Commons Committee.

Witness made no reply to this, and Mr. Coward further asked if the sum to be paid were not the capital expenditure standing in the books of the company.

Witness replied that that was true, but it would have to be certified by the Board of Trade auditor, who would adjust the accounts year by year.

Mr. Coward: The more you waste the more you get?

Witness thought that that was "ridiculous."

In the course of further cross-examination, Mr. Ferranti said that he agreed with Mr. Merz's estimates. The estimates for the mains were based upon an offer by the British Insulated and Helsby Cable Co.

Witness was then cross-examined by Mr. Blennerhassett, K.C., for Westminster, and other counsel representing the local authorities.

Replying to Mr. Macinerney (for Hackney), Mr. Ferranti said that it was impossible to say yes or no to the question whether it was not better to have a good power load and a good lighting load at the same time. So much depended upon circumstances.

By Mr. Rigg, K.C. (for the City Corporation): He did not see why the works of the two companies supplying the City should not be in existence in 1914. The Corporation might either take a supply from the promoters when they took over the stations of the two companies, or they might erect a generating station of their own. He did not anticipate that the Administrative Co. would buy up the two City companies; he could not see that it would be of any advantage.

Cross-examined by Mr. Courthope Munroe (Shoreditch), Witness would not admit that the maximum prices were dependent upon the diversity of the load alone, and not upon the actual load of the consumer.

Sir Wm. White, formerly chief of the Construction Department of the Admiralty, was then called, and gave evidence in support of the Bill.

Monday, July 24th.

A number of witnesses were called to show that there were many manufacturers who would take a supply from the promoters.

Mr. Brooks, the managing director of the Associated Portland Cement Manufacturers, said that at his own works current was generated at a comparatively high price, and he would be glad to have an opportunity of taking a supply at a cheap price.

Mr. John Cowan, managing director of Messrs. Redpath, Brown and Co., gave similar evidence.

Mr. Francis Vernon, the chief engineer to the London and India Docks Co., said that the Docks Co. would be in a position to take a supply in bulk from the promoters if the Bill passed.

Cross-examined by Mr. Vesey Knox: The Dock Co. would require about 90 per cent. of the energy for lighting in some of the docks.

Mr. Vesey Knox put it to witness that the Bill would not allow of so much being used for lighting purposes.

Witness said that he understood they could use the current for what purpose they liked.

Mr. Vesey Knox: But you can use only 20 per cent. for lighting.

Witness said that he was not aware of that; it had not been brought to his notice.

Sir Alexander Binnie was then called, and said that he agreed with the estimates of Mr. Merz in regard to the ring main. If anything, the figures were a trifle excessive. He (Sir Alexander) was the engineer to the Blackwall Tunnel, and he was of opinion that there would be plenty of room for laying the main in the tunnel. He had had, as chief engineer to the Council, considerable experience of the laying of electric mains.

Cross-examined by Mr. Coward, Witness admitted that if the L.C.C. and the Water Board were about to add to their mains and pipes in the tunnel, there would be very little room for the main. He was aware that there was no room in the Greenwich Tunnel for laying the main.

The Committee adjourned early in the day, the Hon. J. D. Fitzgerald announcing that he hoped to conclude the case for the promoters on the next morning.

Tuesday, July 25th.

Mr. A. R. Stenning, surveyor, of the firm of A. R. & F. Stenning, was called, and gave evidence as to the estimates for the land for the generating stations, &c. He said that, having inspected the sites, he considered them quite suitable. The estimates were also quite sufficient.

Mr. James Falconer, chairman of the Mersey Railway Co., was then called to speak as to the financial aspect of the scheme. He said that a company had been formed to promote the Bill, and when it had fulfilled its purpose, it would be wound up. When the measure was first promoted, all the local authorities were communicated with, and, except in a few cases, no answer was received. Then the local authorities joined in opposition to the scheme without having met the promoters. Dealing with the working of the electrical system on the Mersey Railway, witness said that since the installation had been made, the working cost per train-mile had been reduced to 6d. from the former figure of 13d. In such a scheme as that before the Committee, a very large capital expenditure would have to be made before a supply could be given. The question of raising the necessary capital had been gone into fully from the very first, and the promoters and their friends could certainly raise the first issue without going to the public at all. Having conferred with the promoters a few days previously, he was in a position to say that definitely. A number of the promoters were largely interested in the Tyneside undertaking, and for that scheme they and their friends had raised £1,000,000. When, in April last, the Tyneside Co. took over the Durham Co. and issued £350,000 of stock, it was subscribed for three times over. The present scheme had been submitted to Messrs. Baring Bros., who had advised the promoters on the financial matters. As to the purchase clause, he had taken the period of 42 years under the Electric Lighting Acts as a basis in the period. Having regard to the fact that with such a scheme as this, a very large amount of capital had to be spent in anticipation of a demand, a far larger sum than would be necessary in the case of an ordinary lighting company, it seemed to him that some allowance should be made for the development of the company and the business. One method would have been to have suspended the commencement of the 42 years for five or six years, but the consideration which weighed with him and the directors was that the period should be longer than 42 years. He came to the conclusion that 50 years was not an unreasonable period. With regard to the sliding scale, the electric lighting companies were not put under such a scale, and he regarded the sliding scale as the most important control over the company.

The Chairman: But the authorities have a maximum.

Mr. Falconer said that that was true, but it was so high as not to be any control at all.

Cross-examined by Mr. Erskine Pollock, K.C. (for the L.C.C.), Witness admitted that the company which promoted the Bill could, if they wished to do so, transfer the undertaking to any other body after the Bill was passed. There was no likelihood of such a thing being done.

Mr. Pollock: There has been no arrangement about repaying the expenses of the promotion? The promoting company could transfer the Bill to any other company at any price they like.

Witness said that it could be done, but was not likely to be done. The capital of the promoting company, which would be wound up if the Bill became law, was £50,000.

Mr. Pollock: And there is no agreement that the only thing to be paid to the promoting company shall be the actual promoting expenses.

Witness: There is no agreement.

Replying to Mr. Freeman, K.C. (for the Borough Councils), Witness said that about £2,000,000 would be required to set the undertaking on its feet.

Mr. Freeman: Is it true that there are certain large German firms interested in this company?

Witness: No, it is not true.

Mr. Freeman: And you have no firm of contractors backing you?

Witness: No.

Mr. Freeman: Then the company is alone in the world, without a friend outside the promoters.

In reply to further question, Witness repeated the statement that if they did not give a supply at ¾d. per unit, they could not pay a dividend, but he admitted that that meant an average of ¾d.

He thought that the purchase clause carried out the suggestion made in the House of Commons on the second reading. The idea of a local authority purchasing a big station of 100,000 kw. capacity, because it happened to be in its area was absurd. He did not think it was likely that the Borough Councils would join in purchasing the undertaking.

Mr. Freeman: So you really think that this elaborate clause will lead to nothing?

Witness: No, I don't say that. The clause was put forward to meet the requirements of the local authorities. He was responsible for the form of the clause. He did not agree that when the time of purchase came the purchasing authority would be buying antiquated plant. He considered that an auditor of the Board of Trade would be able to engage expert advise as to the value of the plant, if his own experience was not sufficient. He would object to an engineer valuing the plant; he objected to vague valuations.

Mr. Freeman: Vague!

Witness: Well, I think it would be vague.

Mr. Freeman asked witness why the valuation should not be conducted on the lines of the Metropolitan Water Board arbitration.

Witness said that the clause was introduced to safeguard the public from a similar result to that of the Water Arbitration.

Mr. Freeman: I see; this is a self-denying clause?

Witness replied that in the case of the water companies some of them obtained three times their capital value.

Mr. Freeman: I am sure you would not object to that.

Mr. Freeman then questioned witness as to the agreements with the existing companies.

Witness said that, so far as he knew, an agreement had been arrived at in the case of the County Co. Negotiations were pending with others, but he was not at liberty to state the nature of them.

The Hon. J. D. Fitzgerald said that, as soon as any new agreements were arrived at, they would be put before the Committee.

Lord Robert Cecil, K.C., then cross-examined on behalf of the Charing Cross Co. and the South Metropolitan Gas Co.

By Mr. Lewis Coward, K.C.: The purchase clause did not secure purchase at all. He did not agree that the proposals were unprecedented.

By Mr. Rigg, K.C., (for the Corporation): The limited company would have fulfilled its purpose when the statutory company came into existence. The Bill would then belong to the promoters. The question of what the separate shareholders of the company would get would be a matter for consideration.

The Chairman remarked that the matter had been gone into before, but

Mr. Rigg said that no answer had yet been given to the question.

The Committee then adjourned.

North-East London Railway Bill.

Mr. Ashton reporting from the Select Committee on Railways Bills, which considered the above Bill, states that with respect to Clause 91 (agreements as to the supply of energy) and Clause 92 (agreements with Councils and others as to works) the Committee has struck those clauses out of the Bill and substituted new clauses therefor in order to comply with the recommendations of the report. In pursuance of Standing Order No. 145A a report from the Board of Trade was laid before the Committee with respect to the maximum fares, rates and charges proposed to be made applicable to the railways authorised by the Bill, in which it was stated that the fares proposed were in certain respects in excess of those usually allowed in Bills of this class, and that no provision has been made in the Bill with respect to small parcels of a perishable nature conveyed by passenger train exceeding 56 lb. in weight. The Committee have amended Clause 83 (maximum rates for passengers) and Clause 89 (trains and cheap fares for working classes) so as to give effect to the report, and have struck Clause 87 out of the Bill and have inserted a clause prohibiting the company from carrying goods. By the Bill it is proposed to authorise the payment of interest out of capital during the construction of the railways, but it was proved to the Committee that the power to pay such interest would facilitate the raising of the capital authorised by the Bill, and the Committee having found that the restrictions contained in the Bill are in accordance with Standing Order No. 167, recommended that

payment of such interest not exceeding 3 per cent. as proposed by the Bill should be allowed. The Bill contains power enabling the promoters to borrow by instalments in respect of the capital proposed to be raised by the Bill, and inasmuch as such borrowing would facilitate the raising of the capital, and is accompanied by the usual restrictions, the Committee is of opinion that Standing Order No. 153 need not be enforced.

County of London Electric Lighting Co. Bill.

Tuesday, July 18th.

The Court of Referees, presided over by Mr. Parker Smith, sat to consider the objection of the City of London Electric Supply Co. to the London County Council and the Camberwell Borough Council being allowed a *locus* in respect of the Bill.

Mr. Sidney Morse, Parliamentary agent, intimated to the Committee that the London County Council had withdrawn their petition.

Mr. Munroe, who appeared for the Camberwell Borough Council, said that in 1896 the County of London Co. obtained a provisional order on agreed terms for Camberwell. The company had a Bill now before Parliament under which it was proposed to alter some of the terms of the order of 1896, and to impose certain additional terms on the agreement.

Mr. Balfour Browne, K.C. (for the County of London Co.), said they were not proposing to alter any of the terms.

Mr. Munroe said under the Bill it was proposed to vary the terms. The order said that the undertakers should not supply energy or lay down electric mains or works beyond the area of supply except with the sanction of Parliament, and there was also contained in the bargain some curious powers of purchase.

The Chairman said the order appeared to be quite in the common form.

Mr. Munroe said that was so to a certain extent, but under Sec. 60 three different methods of purchase were given, and the whole scheme from the Camberwell point of view was to get a separate and complete undertaking. Now, as a matter of fact, the company, instead of putting up a generating station in Camberwell, supplied Camberwell, through Lambeth, from a generating station in Wandsworth. There had been communications between the Borough Council and the company on this matter, and the Borough Council contended that the action of the company was illegal.

The Chairman: If it is illegal why have you not taken proceedings?

Mr. Munroe said it had not been thought desirable so far to do so, but when the time came for purchase, the matter would have to be gone into. By Clause 19 of the company's present Bill, they were seeking the power to supply for haulage and traction purposes any railway or canal or tramway at a point within the area, for use outside the area.

Sir Chandos Leigh pointed out that Clause 19 would not affect the local authorities' right of purchase.

Mr. Munroe said if the Bill went through, the company could use the existing mains to give the supply for haulage and traction. The Borough Council was only entitled to purchase under the Order of 1896 the undertaking authorised by that Order, and, therefore, anything authorised by the present Bill would not come in.

The Chairman asked if this Act would not be construed as part of the provisional order.

Mr. Munroe thought not.

The Chairman said he did not see where the Council would be damnified, although possibly at the time of purchase if the company was supplying through one of the mains to a railway they might be in an awkward position.

Mr. Munroe said that assuming the Bill passed, and assuming the company laid a fresh main in Camberwell which ran to a point and supplied a railway. When the time for purchase came the local authority would naturally want to make all the profit it could, but they would find that one of their biggest customers would be in the hands of the company from whom they had to purchase. The company would say "You cannot touch the independent cable we have put down with the authority of Parliament."

Mr. Balfour Browne said the company took no power to lay down mains by the Bill.

Mr. Munroe said the local authority had negotiated for the purchase of the undertaking, and were told that a certain portion of the Wandsworth station belonged to them. The company had avoided putting up a generating station in Camberwell, and now they wanted to complicate the matter more by mixing up the business. Since 1896 there had been an attempt to mix it up so that when the local authority came to buy they could not get a separate and complete undertaking.

Mr. Balfour Browne pointed out that there was nothing in the agreement with the Camberwell Borough Council which provided for a generating station in Camberwell.

The Court granted the Camberwell Borough Council a *locus* on Clause 19 only.

Wednesday, July 19th.

Sir A. H. Brown's Select Committee of the House of Commons sat on Wednesday, to consider the Bill of the County of London Electric Supply Co. The promoters were represented by Mr. Balfour Browne, K.C., Mr. Moon, K.C., and Mr. Shaw, and the Camberwell Borough Council, who opposed, were represented by Mr. H. Lloyd, K.C., and Mr. Munroe. The Borough Councils of Southwark and Battersea petitioned against alterations in the Bill.

Mr. Moon, K.C., opened the promoters' case, and said the Bill had passed the ordeal of consideration by Lord Camperdown's Committee of the House of Lords. The County of London Co. was authorised to supply electricity for all purposes in a number of different areas, including Finsbury, Shoreditch, Wandsworth, Southwark, St. Olaves, Camberwell, Holborn and St. Giles. The effect of the company's legislation was to authorise the company to supply in the districts of eight local authorities, with a total area of nearly 23 sq. miles. The company had also obtained a Board of Trade order for the supply to a further large district in the neighbourhood of Croydon. The Bill now before the Committee was mainly to put the company into the position of being able to meet the very largely increased demands for electricity which had arisen and was arising, and also to supply electricity at a cheaper rate. The units sold by the company had increased from 3,000,000 in 1900 to over 7,000,000 in 1904, which was an increase of 140 per cent., while the power units sold had increased from 478,000 units in 1900 (which was the infancy of power supply) to 2,318,000 units in 1904. The company also asked for power to supply electricity for railway companies and tramway companies, to be used not only in the area of supply but also outside the area of supply.

The Chairman asked if it was not the fact that the Bill of the North Metropolitan Electric Power Co., which contained a similar clause, had been carried?

Mr. Moon said that was so. All that they were asking was to adapt past legislation to modern requirements. There were a number of railways which went through their districts, which they might supply if they had the powers. The various districts of the company were supplied from two generating stations—one in the City Road and one in Wandsworth. The company had been in negotiation with both the London and Brighton Railway Co. and the London County Council for a supply of electricity for traction, but, of course, as they had not the power to supply for use outside the area, they were unable to make any contract. The power they asked for was in Clause 19, and the Court of Referees had limited the opposition of the Camberwell Borough Council to this clause. The clause was assented to by all the other bodies in whose districts the company operated, and therefore the sole question for the Committee was whether Camberwell should be excluded from the operation of the clause. By the terms of the Camberwell provisional order of 1896, the Borough Council had power to purchase in 1931, but they could exercise the right of purchase at any time before that date, on condition that they paid £133 for every £100 properly expended by the company on the undertaking, and charged to capital account The petitioners objected to Clause 19, on the ground that it would prejudicially affect them when the time for purchase came, and they pointed out that the powers would apparently all form part of the undertaking, while there would be nothing to prevent the company from using works which would form part of the undertaking. The local authority was afraid that the company might construct works far in excess of the requirements of the borough, and that they would be required to buy them If the company did lay a main for the purpose of carrying out the powers of the clause, it would have to be determined whether that would be part of the undertaking which the Borough Council would have to buy.

Mr Lloyd pointed out that the only power the company had to lay mains, would be under the provisional order of 1896 No power to lay mains was taken under the Bill now before the Committee.

Mr. Moon said that by the Order of 1896 the company was obliged to keep proper accounts of the Camberwell undertaking, which were to be audited by an auditor appointed by the Board of Trade, and further, an arbitrator of the Board of Trade was to determine what had been properly expended on the undertaking. If, therefore, any works were carried out for the purpose of Clause 19, the Board of Trade would not allow it as capital properly expended on the undertaking, and, therefore, the Camberwell Borough Council would not be affected.

The Chairman asked whether, in respect of any works the company might construct for carrying out the powers in Clause 19, they could be bought out.

Mr. Moon replied that the company would be left with those works. They had mains running through other districts in the same way.

Mr. C. P. Sparks, chief engineer of the company, was called, and bore out Counsel's opening statement. He stated that negotiations had taken place with the London and Brighton Railway Co. for a supply of 1,500 kw. to commence their electrification next year, and these negotiations were on the basis of making a contract for seven years. He had also negotiated for the supply of electricity to the London Southern Tramways Co., but the Bill of that company was thrown out by a Parliamentary Committee. It might be necessary to expend money in Camberwell to carry out the powers under Clause 19, but there was no present intention to do so.

Cross-examined by Mr. Lloyd, Witness said the company supplied Camberwell from the Wandsworth generating station, and the auditor charged part of the machinery to the Camberwell undertaking. Up to the present about £24,000 was charged for machinery. If the present mains were utilised for the powers under Clause 19, he supposed they would be charged to Camberwell as part of the undertaking.

Mr. R. Renwick, secretary of the County of London Electric Supply Co., said the Board of Trade auditor would decide what mains should be charged to Camberwell. At present certain mains in Camberwell were not charged to capital.

After further discussion, the Committee intimated that they would be prepared to pass the preamble if the promoters would bring up a clause dealing with any mains which might be laid for the purposes of Clause 19.

After an adjournment, Mr. Shaw submitted the following proviso to Clause 19:—"Any expenditure on electric lines to be laid down by the company in the Metropolitan Borough of Camberwell for the purpose of this section shall not be charged against the Council of that borough in the event of their purchasing the undertaking authorised by the Camberwell Electric Lighting Order, 1896, under Sub.-sec. 2 and Sub.-sec. 3 of Sec. 60 of that order."

The Committee adopted the clause.

Central Electric Supply Co. Bill.—The Court of Referees, on Tuesday, July 18th, had before them the objection of the Central Electric Supply Co. to the London County Council being allowed a *locus* against their Bill now before Parliament. Mr. Blennerhassett appeared for the County Council, whose *locus* was disallowed except so far as it had reference to Clause 4, which related to the question of the Building Acts.

Aberavon Tramways.—The Chairman of Committees of the House of Lords has informed the House that the promoters of the Aberavon Tramways Order in Tramway Orders Confirmation Bill (No. 2) do not intend to proceed further with the order.

Third Reading.—In the House of Commons on July 20th the North-East London Railway Bill was read a third time.

In the House of Lords on July 21st the Great Northern, Piccadilly and Brompton Railway (No. 1) Bill was read a third time, amended and passed.

In the House of Lords on Monday the Shropshire, Worcestershire and Staffordshire Electric Power Bill, the Paisley District Tramways Order Confirmation Bill, and the Glasgow Corporation (Tramways Consolidation) Order Confirmation Bill were read a third time.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"Cable" writes:—"Can you say whether an electrical supply authority (corporation or company) can legally make a charge for laying in a supply main from a street where no private service is used, except the short length through the wall and to fuses, say, 2 ft.? Can they give any reduction in the price of current consumed by one shopkeeper, while another pays the ordinary price charged in the district?"

*** The law relating to the first question put by "Cable" appears to be laid down in the schedule to the Electric Lighting (Clauses) Act, 1899. It is there provided (by Clause 27) that the undertakers shall, upon being required to do so, by the owner or occupier of any premises situate within 50 yds. from any distributing main of the undertakers in which they are, for the time being, required to maintain or are maintaining a supply of energy for the purposes of general supply to private consumers under the special order or the Board of Trade regulations, give, and continue to give, a supply of energy for those premises in accordance with the provisions of the special order and of the said regulations, and they shall furnish and lay any electric lines that may be necessary for the purpose of supplying the maximum power with which any such owner or occupier is entitled to be supplied under the special order, subject to the conditions following (that is to say): The cost of so much of any electric line for the supply of energy to any owner or occupier as may be laid upon the property of that owner, or in the possession of that occupier, and of so much of any such electric lines as it may be necessary to lay for a greater distance than 60 ft. from any distributing main of the undertakers, although not on that property, shall, if the undertakers so require, be defrayed by that owner or occupier. It follows from this that if the boundary of the consumer's premises is within 60 ft. of the mains that distance must be spanned by the undertakers at their own cost; the cost of the lines laid on the consumer's premises must be paid by the consumer.

The second question appears to be answered by the Electric Lighting Act, 1882, Secs. 19, 20. Sec. 19 provides that where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided by the terms of the provisional order authorising such supply, every company or person within that part of the area shall, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply; and by Sec. 20 the undertakers shall not, in making any agreement for a supply of electricity, show any undue preference to any local authority, company, or person, but, save as aforesaid, they may make such charges for the supply of electricity as may be agreed upon, not exceeding the limits of price imposed by or in pursuance of the licence, order, or special Act authorising them to supply electricity. It is apprehended that these sections operate to prevent undertakers making any difference in their treatment of two shopkeepers within their district.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electrical Engineering Extraordinary in South Africa.

In craving a small amount of your valuable space, I must offer as my excuse, amongst other things, that this is my first offence, and that my subject is of the utmost importance to the engineering profession.

At the present time South Africa is inflicted with a surfeit of gentlemen sent thither by firms of good standing in the electrical industry, both in England and other countries (although, being a firm believer in Mr. Chamberlain's fiscal policy, I have more interest in the former), to represent them in the electrical engineering industry. That these gentlemen have most inestimable social and commercial qualities is without a doubt, but that they have only the most meagre technical knowledge is, I regret to say, the rule rather than the exception; in fact, in most cases, the representatives of large electrical engineering firms in this country are purely gentlemen versed in commercial knowledge and entirely devoid of technical knowledge of the important specialities they represent.

Can it be wondered at then that electrical engineering in South Africa is suffering from "quackism," and that the industry is stultified, and is not making such rapid strides as those interested in the "profession" from more than a mere avaricious point of view could wish?

I do not for one moment say that it is necessary or even possible to find gentlemen possessing both the requisite technical and commercial training to represent such firms in South Africa, especially when it is understood that intrigue plays such an unfortunately large part in all business, and that in the case of the engineer, if he gives such time and attention to his profession as will enable him to master its intricacies, he has not the time at his disposal to fathom the sordid idiosyncrasies of commercial life.

It would therefore appear necessary, if adequate representation is to be afforded to such an important industry, to provide the services of both a qualified engineer as well as a commercial manager.

I am afraid that the electrical engineers and their "Commercial Satellites" in England are inclined to look down upon the electrical engineers of South Africa, but do not let the fact be lost sight of that the electrical engineers of South Africa are the "Pioneers of the Electrical Empire."

In this country electrical engineers have many and vast obstacles to surmount before their objects can be achieved, and yet how often are schemes in this country condemned out of hand by visiting engineers because such economies are introduced as overhead mains, and such expensive apparatus as superheaters, feedheaters, &c., are omitted, and "smoke stacks" are made of steel and are not superb and expensive structures of brick.

Is it supposed for one moment that the designer of the scheme did not know that underground cables are more desirable than overhead mains, or that brick stacks are more beautiful than common steel ones, or, again, that feedheaters and superheaters, &c., lead to economies which vastly outbalance the annual charges on the first cost? I say is it supposed that the designer did not know these facts? If so, let my criticising technical brethren pack up and return whence they came before the superstructure of reasoning, based upon such a false foundation, crumbles about their ears.

There is only one reason, and can only be one reason, for not introducing such economies into the first cost of a scheme, and that is shortness of capital, for had the designer included in his estimates all the appliances he would have wished to have seen installed, then the necessary capital would not have been forthcoming and the scheme would not have had existence.

Let us go a step further. In this country technical labour is expensive and rare, and engineers are called upon to carry out vast schemes without the usual engineering facilities; it therefore behoves them to have an intimate and practical knowledge of all details of their profession. In some cases it has been necessary for the engineer-in-charge to give actual practical tuition in some remote branch of engineering

science, and woe betide him if he has not had the advantage of a sound and practical training, and has not an intimate knowledge of his profession—he little wots of the troubles that await him in South Africa.

Then how in the name of goodness can manufacturing firms suppose that commercial men, who go through every conceivable contortion, and twist themselves into every conceivable shape in their endeavours to carry on such a technical business as electrical engineering, can ever be a success?

Neither are the technical men always truly commercial, for within a very recent period one of the satellites of high standing in that particular branch of the electrical industry visited our shores, and during his sojourn amongst us was requested to give an opinion upon a case where a foolish mistake had been made. The circumstances of the case were briefly as follow :—

A small supply company having somewhat outgrown its distributing system (a common ailment which distributing systems have, especially when requested to perform a much greater duty than they were designed for), the supply company had (no doubt through inadequate technical advice) made the foolish and elementary mistake of planking down another generating station at the end of the line and in a sparsely populated district, and, forsooth, had equipped such generating station with oil engines.

The question asked the satellite was what should be done now?

The answer given was :—"As you have installed the oil engines, keep them, otherwise I should have recommended you to increase your copper."

Imagine it, what an uncommercial technical satellite, to give advice to run two stations, pay out extra wages, incur the extra annual charges of depreciation, repairs, stores, &c., on running a station, rather than, having made a mistake, to get out of it as cheaply as possible, and increase your copper and make use of the plant you already have, and thereby make an enormous annual saving.

But, perhaps, I am at fault, it is not so much a question of the "uncommercial technical man" as the "commercial non-technical man;" however, have it which way you will, it has equal weight of argument.

But to return from my digression. Let me give two amusing, but true, instances which serve to bring home to my professional brethren some absurdities to which this commercial would-be-technical element leads.

In one case the "representative" of a large engineering firm asked a South African engineer if there were many steep gradients on the Cape Government railways, and on being informed that there were many gradients of 1 in 40 he replied :—"Oh! that is nothing, in my professional travels, I have come across many railways with gradients as steep as 1 in 80!"

Being of a polite nature and not wishing to hurt the representative's susceptibilities, the South African engineer said :—"Yes," and smiled, but like the parrot, he thought a lot, and being charitably inclined put it down to a disordered bread basket due to the combined effect of a sea voyage and a change of climate.

In the other case the "representative," being shown some new boilers, and being informed that they were rather expensive, remarked, "Why? are they all cast in one piece?"

In this case I believe the smile broadened, but after all the poor "representative" was not to blame; he was placed in a false position, and was only doing his best to sustain his end of life's little burdens.

In conclusion, let me say that the engineers of South Africa have the temerity to consider themselves equal to their technical brethren in the same status "at home." After years of practical experience in a country practically devoid of the usual engineering facilities for carrying out work, I have definitely come to the conclusion that they are not far wrong, but I have also arrived at another conclusion, and that is, that "representatives" in South Africa do more to retard the progress of the electrical industry and "hammer nails into its coffin" than anything else.

E. J. Clifford-Jones.

Cape Town, *June 26th*, 1905.

Telephone Etiquette.

For some time past the unsatisfactory arrangements made by some firms with their telephone service have been the cause of some little vexation to myself and to others.

To illustrate my meaning, I will relate an experience of yesterday :—I had occasion to call up a well-known firm of cable makers, and on getting through was greeted by a small boy with the usual, "Who are you"; having given full particulars and stated the nature of my business, I was told to "Hold on," and after a little delay a female voice required to know who I was and my business. This I repeated, and once again was requested to "Hold the line." Some further delay occurred; then a man's voice called, "Who are you?" This I again stated, and thinking at last that I had got hold of the proper person to deal with the matter, I entered fully into the business. I was required to "Hold on" the third time, and a second man's voice desired to know who I was. Evidently not one word of the information given to the three previous speakers had been passed on. I protested that I had already given this information, and stated my business to previous speakers; thereupon the gentleman at the telephone took umbrage and hung up his telephone, and the order which I desired to place with the firm has been given elsewhere. Surely there should be no difficulty in arranging for the lad at the telephone to take down the name and message, secure the attendance of the gentleman who could deal with the matter, and state the information already received.

If this were a solitary case, it, perhaps, would not be worth while asking you to draw attention to the matter; but a number of firms that I have to deal with manage their telephone in the same manner, causing a woeful waste of time, not a little vexation, and sometimes, as in the above case, loss of business.

Telephone.

C. & C. Patent Trolley Head.

In your short but excellent comment upon our invention, the "Cherry & Clive" patent trolley head (shown by our agents, Messrs. R. W. Blackwell & Co., Ltd., at the Tramways Exhibition), there was one remark meant to be favourable, but misleading somewhat, and detracting from the efficacy of our invention, and is not according to the perfected principle we have produced. Your report stated that "the wire finders can be brought into the best position by *twisting* the rope." After years of thought we have arrived at the *independent revolution* of the fork and wire finders; so that the rope is *not intended to twist* either by accident or the operator's will. This independence of revolution is *produced* by a *revolving* table on the top of the shaft; this table, when lowered by the pulling of the rope by the operator, jams the two rocking levers, which force up the two vertical links, which raise the two wire finders and hold them erect until they claim the current wire. The fork, &c., *not only* revolves *in* the pocket of the frame, but *also around* the centre shaft, which shaft is *held stationary by the* rope's *downward* pressure. I feel sure you will permit this explanation to reach your subscribers, as the above remarks are according to our specifications (provisional and complete accepted), and this improvement is *re-patented* upon our master patent, which you so kindly alluded to January 8th, 1904.

John T. Cherry.

Plymouth, *July 23rd*, 1905.

N.B.—Our patent trolley head is known now as the "C. and C. Trolley Head" among business firms.

The Value of the I.E.E.

I had intentions of asking you to insert a letter in these columns in answer to the above correspondence a few weeks ago, but on second thoughts refrained from doing so, thinking it might only be waste of time; but as the so important matter is being taken up let us hope for some sound lines of reform.

"Is a member admitted into the Institution by his ability or his popularity?" The majority will answer the latter, and in my case I have found it so. One need not suppose I

am prejudiced because I have not been successful, and I don't think I am the only one who has been so unfortunate as not to be able to grasp the hand of a M.I.E.E.

About two years ago, desirous of becoming an associate, I wrote for and received a form to be filled in, together with regulations, &c. I therewith started writing to the engineers I had served. Some replied, others did not—as to what became of them or my letters I could not say; those who replied gave me every assistance, but, alas, I was one M.I.E.E. short, which up till now still remains the case. As a great deal of time was being lost looking for the missing one, I thought it advisable to write to the secretary (giving him all particulars of training, &c.) who might give me some assistance, but to my surprise he told me he was unable to do anything in the matter until I could get the other signature, also enclosing another revised form.

I cannot see my way clear to keep moving about in order to secure the signature I require, consequently I have given it up. I may say I am not one such as "Common Sense" describes in his No. 1, for I have had 3 years' practical workshop and 5½ years' central station experience, including apprenticeship, assistant and charge.

I write this not to be shouldered into the "golden bed," as no doubt many are, a few of whom I know of.

Thanking you for the insertion of this, and hoping for a better system to test ability, until then I am

Hopeless.

"Steel Direct."

The steel turned out, on analysis, to be white pig (carbon 2·38); beyond this, I offer no comment on this remarkable piece of apparatus, and the still more remarkable claim for making steel direct.

I will, however, for your information, submit the following, as it bears directly on the electric smelting of ironsand.

Some months ago I was requested by a New Zealand syndicate to report upon the possibilities of making iron and steel from ironsand. I operated upon some 35 cwt. of the sand without briquetting, first reducing it to pig-iron, and then, by a second process, converting this pig to steel. The result of the double operation was 18 cwt. of good marketable steel, made up in billets. This steel (or some of it) was made up in Sheffield, and now takes the form of files, saws, knives, &c.

The cost of electric energy in the first operation was roughly 8s., and for the second operation 8s. 6d., basing these figures on the 40s. per E.H.P.-year valuation. No effort was made in the direction of efficiency or the prevention of waste.

There is not the slightest doubt as to the value of the process for this New Zealand industry. The type of furnace used by me for the work was the "arc," which very readily lends itself to re-fluxing and perfect refining. I have my own patented furnaces for the two processes, and am now building both to a capacity of 2 tons. I shall be pleased to send you samples of the steel made from ironsand, and to afford any fuller information.

The time occupied in the two operations referred to by me was 36 hours, but I was working with a small furnace and under difficulties.

T. Scott Anderson.

Sheffield, *July 24th*, 1905.

[Owing to great pressure upon our space, a letter on "Political Blackmail" is held over to next week.—Eds E.R.]

LEGAL.

Gorry *v.* Slatter.

Mr. Justice Ridley, in the King's Bench Division on Saturday, heard this action, in which the plaintiff sought to recover a sum of £500 alleged to be due under a covenant in a deed dated June, 1899. The defendant was an electrical engineer, and chairman of the High Wycombe Electric Lighting Co.

Mr. Shewell Cooper, for the plaintiff, said she was desirous of having her son apprenticed to the defendant to learn the business of electrical engineering, with a view to his becoming a partner and purchasing a share of the business. For this purpose she advanced the defendant £650, of which £150 had since been returned, the remaining £500 being set off against the share of the business. Plaintiff's son received a salary of £2 a week, and it was provided in the deed that if the interest was duly paid and no covenant broken, the principal sum was not to be called in, except in accordance with the terms of the agreement. It was, however, mutually agreed in February, 1901, that the share of the business should not be purchased, and plaintiff's case was that, on that agreement being come to, what was left of the deed became a simple mortgage, and that the principal money could be called in.

Mr. Gore Brown, K.C., for the defendant, said the money had been advanced to put into the business, and it was known to both parties that it could not be repaid without breaking up the business. It was for that reason that the express bargain was made, that so long as the defendant paid interest and did not make default he should not be required to pay the principal. The fact that he had been released from taking plaintiff's son into the business did not alter the bargain.

His Lordship said it was true that as the deed was originally drawn, the usual result of a mortgage was interfered with by the proviso, but the proviso turned on the clause by which plaintiff's son was to become a partner. The money was not to be repaid except by taking him into partnership. When that clause ceased to exist the whole reason for the proviso was taken away. The money was clearly repayable, and there must be judgement for the plaintiff.

Rene & Co. *v.* Wolf.

In the Lord Mayor's Court, on July 19th, judgement was given in this case. The case was previously before the Court, the proceedings at the time being reported in the columns of the Electrical Review. The plaintiffs had brought an action against the defendant to recover the price of goods supplied. Amongst the items sued for was the price of certain electric sparking plugs. These the defendant refused to pay for on the ground that the bulk supplied were not according to sample, and were defective by reason of their becoming short-circuited when used in a motor engine. The Assistant Judge, Mr. F. S. Jackson, before whom the case was tried, had the assistance of Mr. Cozens-Hardy as an assessor. The Assistant Judge said that at the trial it was agreed that Mr. Cozens-Hardy should take away a certain number of the plugs for the purpose of tests being made. Those tests had now been made, and he (the Assistant Judge) had received a report. According to that report Mr. Cozens-Hardy came to the conclusion that the mica cigarette in the plugs supplied by the plaintiffs was not in accordance with the sample, and that although some of the plugs were capable of being used on motor-cars, they occasionally missed fire. When there was a breakdown it was generally at the end of the mica cigarette. Upon the report he would enter judgement for the defendant. Leave to appeal was given.

BUSINESS NOTES.

The King's Visit to Manchester.—On the occasion of the King's recent visit to Manchester, the manufacturers of Trafford Park combined to erect a triumphal arch, and a photograph of this has been sent to us. The idea is somewhat original, inasmuch as the arch is composed of manufactured products of almost every kind. At the back of the arch to the left the Westinghouse Co. had the carcass of a large alternator. The cables of Messrs. W. T. Glover & Co., Ltd., stood out well, and various other electrical industries in the park occupied prominent positions. The principal motto, printed right across the arch, "Wake up, England; Trafford Park is Awake," was rather a happy one, and we understand that it drew a letter of interest and comment from the Prince of Wales. The other mottoes at the sides were "Facilities Beget Trade" and "Trade Begets Prosperity."

Tramway Contract.—We understand that Messrs. J. G. White & Co., Ltd., who are now making an issue of capital, have just secured a contract amounting to upwards of £400,000 for the complete construction of tramways, &c., at Para, Brazil.

Electric Motors in Gas Works.—The British Electric Plant Co., Ltd., have obtained an order from the Falkirk Corporation for the complete equipment of electric motors for their new gas works. This gas works is believed to be the first in Great Britain to be completely and exclusively driven throughout by electric motors. The power will be supplied from the Falkirk Corporation electric supply station.

Switchgear Contracts.—Messrs. Ferranti, Ltd., have recently received the following orders for switchgear, &c:—

Cardiff.—Motor-generator switchboard.
Burnley.—D.C. switchgear extension.
Newcastle and District Electric Lighting Co., Ltd.—D.C. switchgear extension.
Metropolitan E. S. Co., Ltd., Willesden.—3,000-kw. 11,000-volt switchgear extension.
10 A.C. and D.C. switchboards for private installations.
Heriot-Watt College, Edinburgh.—Three 10-kw. A.C. transformers.
Mauritius.—Two 20-kw. three-phase transformers.

French Trials of Electrical Motor Vehicles.—Owing to the restricted number of entries, the French Automobile Club has resolved to postpone the trials of electrical vehicles which were to have been held early next month.

Sunbeams at Play.—The workmen with members of the staff of the Sunbeam Lamp Co. journeyed to Redcar on Saturday, the 22nd inst., for their annual outing. A very enjoyable time was spent. Sports were indulged in during the morning, and the rest of the day was given up to boating, bathing and driving. The company partook of a substantial repast at the Old Swan, afterwards driving in brakes to Saltburn and returning to the hostelry for tea. Mr. T. J. Grainger presided at the dinner, supported by Mr. Herbert Edmundson, Messrs. Young, Berresford, Potts, Barrass and others. The principal toast, "The Sunbeam Lamp Co.," was given by Mr. W. Young, who remarked upon the success which had attended their efforts during the past year. With such captains of industry as Mr. J. W. Edmundson, the managing director, Mr. H. Edmundson, and a commercial man of such business acumen as Mr. Grainger at the head, greater success in the future was assured them. Mr. Barrass, representing the Glass Works now identified with Sunbeam, supplemented Mr. Young's remarks. Mr. Grainger and Mr. H. Edmundson responded. The former gave some very interesting figures as showing the great advance the company had made since it began manufacturing, how the output had steadily increased, and their position in the market to-day. Only that morning, said the secretary, further orders had come to hand from the Admiralty, and generally their business, despite the competition of the foreigner and competition at home, was in a highly satisfactory state. He welcomed the glass-makers who were present with them in a social way for the first time, expressed pleasure at the cordial relations which existed between management and men, and provided they each did their part in the various operations in which they were engaged, he predicted a still brighter future for the Sunbeam Lamp Co. The assistant manager, Mr. Edmundson, briefly responded. Votes of thanks to the firm for generously contributing to the outing, and to the committee responsible for the arrangements, were heartily accorded.

Book Notices.—"Steam Engineering: A Treatise on Boilers, Steam, Gas and Oil Engines and Supplementary Machinery." By W. W. F. Pullen. Second edition. Manchester: The Scientific Publishing Co. 4s. net.

"The Engineering Standards Committee's Report on the Effect of Temperature on Insulating Materials." Report No. 22. London: Crosby Lockwood & Sons, and The Committee, 28, Victoria Street, S.W. 5s. net.

"The Physical Review." Vol. XXI., No. 1, July, 1905. Under the co-operation of the American Physical Society, Lancaster, Pa., N.Y., and London: Macmillan & Co.

"Electric Traction." By R. H. Smith. London and New York: Harper & Bros. 9s. net.

"Commercial Economy in Steam and other Thermal Power Plants as dependent upon Physical Efficiency, Capital Charges and Working Costs." By R. H. Smith. London: Archibald Constable and Co. 24s. net.

We have received a copy of the first number of the *Rhodesia Review*, a quarterly for shareholders and settlers. It is edited by Mr. Percy Lindley, and can be obtained at 30, Fleet Street, E.C. It is a publication which will interest those who are following the course of Rhodesian affairs and finance.

Catalogues and Lists.—Messrs. Frampton, Paine, and Jackson, 29, Old Queen Street, Westminster.—Illustrated price list of ventilating fans, table, bracket and ceiling patterns, railway carriage, porthole, and other types. Sizes, code words, weights and prices are given.

Mr. C. R. Heap, 28, Hatton Garden, E.C.—Circular describing the "Case" controller for crane motors, hoists, and all work where a wide range of speed is required.

The Electrical Trades Supply, Ltd., Britannia Works, Great Charles Street, Birmingham.—Various new publications have just come to hand. One is a catalogue and price list of electrical porcelain ware; another is an abridged list of cord pendants, ceiling fittings, brackets, electroliers, and standards; a third is a well-illustrated and interesting catalogue of portable electric drilling machines, and yet another gives prices and illustrations of E.T.S. damp and dust-proof electrical fittings for collieries, ironworks, ships, mills, &c.

Messrs. Babcock & Wilcox, Ltd., London.—Interesting pocket pamphlet with many reproductions from photographs, showing their well-known water-tube boilers in use in electric light and traction stations in all parts of the kingdom. An imposing list of some of the more important stations at home and abroad is given as evidence—if any be needed—of the great popularity of this boiler.

Mr. Douglas Wells, Brussels.—A 54-page pocket-size catalogue, printed in French, of the electric conduit wiring and fittings specialities of the Metallic Seamless Tube Co., Ltd., for which Mr. Wells is Continental agent.

Messrs. J. H. Tucker & Co., Sampson Road North, Birmingham.—Full catalogue (64 pp.), giving particulars, illustrations and prices of a great variety of electric lighting accessories, including tumbler switches, ornamental switch-covers, wall and floor sockets, distributing fuseboards, ceiling roses, counterweight sets, cut-outs, lampholders, knife and other types of switches, &c.

Messrs. Mavor & Coulson, Ltd., Glasgow.—August calendar card, on the reverse side of which are given curves plotting data relating to a Pick-Quick electric coal-cutter installed at a Lanarkshire colliery.

Messrs. Wallach Bros., 57, Gracechurch Street, E.C.—List of the "Evertrusty" wire-embedded gauge-glass protectors.

The Improved Electric Glow Lamp Co., Ltd., 7, Great Newport Street, W.C.—Illustrated circular of their new patent Titania fans and scent-diffusers.

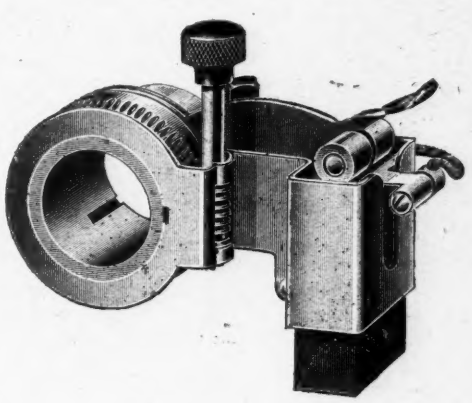
Aron Electricity Meter Ltd., 114, Union Street, Borough S.E.—"Notes on Meters and Useful Data" is the title of a new pamphlet just received containing numerous illustrations of the Aron types of meters (motor, switchboard, supply type, battery, tramcar, and other meters), and a good deal of information of value relating to them. Particulars of some recent improvements, such as silent winding, help springs, and springing counter are detailed.

Messrs. Michael Pal & Co., Parliament Mansions, Victoria Street, S.W.—Circular of their Palite commutator compound.

Western Electric Co., North Woolwich.—Information Bulletin No. L 102, describing their latest type of telephone set, specially adapted for electric traction systems.

The General Electric Co., Ltd., London.—New catalogue, well illustrated, dealing with the "Witton" single and polyphase induction motors. A full specification of the motors is printed accompanied with views of parts and complete motors, also particulars and prices of starters, tables and diagrams of dimensions. Half tone views are given of three-phase motors supplied to the Manchester Corporation, Woolwich Corporation, Westminster Electric Supply Corporation, and the Admiralty's new naval hospital substation. The company has recently made great progress with its single and polyphase machinery, and has obtained contracts therefor among other places, South London, Hastings and Reigate for single-phase, and Dublin and Cardiff for three-phase.

The Aston "Worm Feed" Brush-Holder.—The brush-holder illustrated herewith forms one of the many specialities of Messrs. Veritys, Ltd., of Aston, Birmingham, who are the patentees and sole makers of the device. The holder shown is of the box type, and is arranged for rigidly fixing to the brush pillar. In order to do this the tube of the holder is split through half its length, and an encircling clamping ring and key serve for tightening on to the pillar. The carbon brush is pressed down through the



holder by two small rollers attached to the end of a lever pivoted on the brush pillar. The worm gear, also centred on the latter, when rotated by means of a thumb-screw, exerts through a spring connection the requisite pressure on the lever and brush for the required adjustment. The lever is extended beyond the pressure rollers to provide a ready means of raising it, to try the tension or remove the carbon; its downward movement is confined to a slot, and it cannot touch the commutator. As the thumb-screw is provided with an insulated knob, it can be safely adjusted while running. This simple device has been approved in many quarters, and will doubtless interest all dynamo and motor users.

Automatic Fire Alarms.—From the *Aberdeen Free Press*.—The utility of the May-Oatway fire alarm was demonstrated on 21st inst. in connection with an outbreak of fire at the meal mill in Berryden. The fire was caused by an overheated bush on the first floor of the mill, and at once the alarm automatically notified the fire brigade of the outbreak. Nothing was known at the mill about the fire until a telephone message was received from the fire brigade station. On receipt of the information, steps were instantly taken to put out the fire, and the result was that by the time the brigade had arrived the flames were extinguished.

News has also come to hand from New Zealand to the effect that the Deaf and Dumb Institute at Sumner (a wooden building) recently got alight, but the May-Oatway alarm is said to have saved it from total destruction. There were no lives lost, and the damage was trifling.

To British Automobile Makers.—Messrs. Langdown & Co., importers and inventors, of Christchurch, New Zealand, have written to the British Empire Motor Trades Alliance, of 11, Red Lion Square, W.C., asking for catalogues of automobiles and accessories of all British manufacture, together with best prices f.o.b. for cash in London. Separate quotations are asked for, for chassis and cars complete of from 5-h.p. to 16-h.p., also chassis suitable for delivery vans and omnibuses. Communications should be sent direct to Messrs. Langdown.

Hardware and Electrical Exhibition.—On Tuesday the sixth annual International Ironmongery, Hardware and Electrical Trades' Exhibition and Market was opened at the Royal Agricultural Hall, Islington. It will continue open until August 4th.

Dissolutions and Liquidations.—At a meeting held on June 30th at Temple Bar House, E.C., it was resolved to wind up WM. AUG'S GIBSON, LTD., voluntarily. Creditors must send particulars of their debts, &c., to W. A. Gibson and R. Lawson, 34, Old Broad Street, E.C., the liquidators, by September 1st.

THE POOLE AND DISTRICT ELECTRIC TRACTION CO., LTD., is winding up voluntarily, with Messrs. E. Garcke and W. F. Cox as liquidators. Creditors must send particulars of debts, &c., to the liquidators, at Donington House, Norfolk Street, W.C., by August 30th.

Messrs. A. Isherwood and G. R. Burnett (SHEFFIELD ELECTRIC BELL AND TELEPHONE CO., electricians, engineers and contractors, Sheffield) have dissolved partnership.

Sales.—The break-up sale of the machinery and plant of VICTOR COATES & CO., LTD., at Belfast, was brought to a close on 21st inst. by Messrs. Wm. Montgomery & Son, the auctioneers.

Aston Manor Education Committee is inviting tenders for the purchase of gas engines, dynamos, switchboards, &c., fixed at the Technical School. The Electricity Department is inviting offers for a quantity of tariff clocks and time switches. Particulars appear among our "Official Notices" to-day.

Motor-Car Cable Troubles.—MESSRS. W. T. GLOVER AND CO. have issued a neat and substantial card, drawing attention to the special patent oil-proof and static-discharge-proof cables which they have devised, to overcome the troubles met with in connection with the ignition wiring of petrol engines. The card includes lighting-up tables, and will be sent to any reader on application.

Trade Announcements.—The HIGH TENSION CO., of Charlton, notify that they have removed their works to a more central situation, and their address for all communications in the future will be Hanway Street Works, Oxford Street, W.

MESSRS. FALK, STADELMANN & CO., LTD., with a view to better coping with the increasing bulk of their Scottish trade, are opening a branch establishment consisting of warehouses, show-rooms and offices at 74, 76 and 78, Great Clyde Street, Glasgow, to which address communications relating to Scottish business should be addressed after August 1st. Mr. A. C. Taylor is going from London to act as manager of the branch, he having had special experience of the requirements of Scottish trade.

MESSRS. HOME & ROWLAND, of Troughton Road, Old Charlton, S.E., who make a speciality of repairs and rewindings of continuous current and polyphase plant, new commutators, &c., have taken additional premises adjoining their present works to enable them to deal promptly with a large accession of business.

MESSRS. L. ANDREW & CO., of 2, Carr Street, Blackfriars, Manchester, agents for the Anchor Cable Co., Ltd., announce that they are now holding a large stock of "Anchor" vulcanised india-rubber cables and wires in all the standard sizes, and in 300, 600 and 2,500 megohms grades.

MESSRS. W. F. MASON, LTD., of Alma Works, Levenshulme, Manchester, who, as recently announced in these pages, have sold the portion of their business relating to the manufacture and sale of gas producer plant and furnaces, together with their works and patent rights, to Mason's Gas Power Co., Ltd., have arranged with the new company for the necessary accommodation for the other branch of their business pending the completion of new works. The chairman of Mason's Gas Power Co. is Mr. Wm. Beardmore, of Wm. Beardmore & Co., Ltd., of Glasgow. All communications should be addressed either as above or to Sanctuary House, Tothill Street, Westminster.

With reference to a notice under this heading on page 1054 of our issue of June 30th, we understand that, although Mr. ERNEST ROBERTS has severed his connection with MESSRS. NALDER BROS. AND THOMPSON, LTD., any orders that may be sent through him will be executed as heretofore.

Wrexham Refuse Destructor.—We understand that Wrexham has again demonstrated that the combination of refuse destructor with electricity works can, under able management, be worked successfully. Mr. Sillery, the electrical engineer, reported, on June 7th, to his Committee that the Meldrum destructor had worked continuously for 12 months without stoppages, and without incurring a cost of one penny for repairs.

Dividend.—A first dividend of 10s. in the £ in *re* McGuire Manufacturing Co., Ltd., is payable from July 21st at 58, Coleman Street, London, E.C.

Annual Outing.—The annual picnic of the employés of the Liverpool Electric Cable Co. took place on Saturday, July 15th. An early start was made from Liverpool, the party travelling by the L. and Y. electric railway to Southport. A most enjoyable day was spent, all the sights, amusements and places of interest coming in for attention and being thoroughly appreciated.

Canadian Steel.—As the result of the important investigation recently carried out by the commission which was sent to Europe to inquire on behalf of the Canadian Government into the manufacture of steel by electrical processes, it has been decided by the Government to allot a sum of £3,000 for the purpose of experiments at Sault Ste. Marie. The Héroult system will be employed, under the supervision of the inventor. There is an abundance of iron ore in Ontario, in the neighbourhood of available water powers, and there is every reason to believe that an important steel-making industry will be established in that province.

LIGHTING AND POWER NOTES.

Ashton-under-Lyne.—By 18 votes to 12 the Board of Guardians has rejected a proposal to rescind a previous decision to install the E.L. in the new hospitals, and a loan of £5,000 has been applied for to carry out the work.

Ballymena.—The *London Gazette* for July 25th contains notice that the B. of T. has revoked the 1897 electric lighting order.

Barking.—The U.D.C. has arranged for the transfer of the electrical undertaking to the Administrative County of London Electric Power Co., which will supply energy at 4d. per unit for private lighting, and 1d. per unit for power. The company will take over liabilities not exceeding £100,000.

Birmingham.—The Electric Supply Committee has recommended the T.C. to apply for a loan of £99,550 for additional machinery at Summer Lane Station, the extension of sub-stations, and cables.

Brighton.—Accounts of the electricity undertaking for the past year have just been prepared, and show a gross profit of £36,565. The net result, after providing for all charges, is a surplus of £5,381. This sum, it is proposed, shall be carried to the reserve fund, which will then amount to £21,112.

Bridlington.—The T.C. has applied to the L.G.B. for a loan of £4,500 for E.L. purposes.

Burnley.—On July 19th a L.G.B. inquiry was held relative to the application of the T.C. for loan of £16,194 for electricity purposes. There was no opposition.

Buxton.—The electrical engineer has submitted particulars of various requirements, including new plant and foundations, the estimated cost being £4,000, and application is to be made to the L.G.B. for its sanction to a loan.

Canada.—OTTAWA.—The Consumers' Electric Co., which is being expropriated by the Corporation, has put a price of $194,000 on its plant, and asks for dividends on its investment which bring the price up to $225,000. The estimated value of the property is $180,000.

The City Council has decided by 16 to 5 to pay the company the sum of $200,000 for the plant, &c. Should this offer not be accepted, the question will be referred to arbitration.

NAPANEE (ONT.).—It has been decided to raise $35,000 for a municipal electric light scheme.

Chertsey.—Messrs. Foote & Milne have informed the R.D.C. that they have abandoned the idea of overhead lines for supplying energy to Chobham and Windlesham.

Continental Notes.—ITALY.—The Italian Government has introduced a Bill which proposes to grant facilities to foreign capitalists, with slight assistance to be rendered by Italian investors, for working the numerous deposits of lignite existing in the country. Apart from this, the bank known as the Credito Italiano, has just formed the Società Mineraria ed Elettrica del Valdarno to take over the large liguite mines of the Ferriere Italiane. It is intended to work the mines on an extensive scale, and utilise the fuel for the production of electrical energy, which is to be supplied for lighting and power purposes in the industrial part of Tuscany. The capital of the company has been fixed at £160,000, and it can be increased to £240,000 at any time the directors may consider it desirable to do so.

Permission has been granted to Messrs. E. Ugolini & Modugno, to establish a hydro-electricity works on the River Coscile for supply of energy to the Cosenza Cotrone railway.

The Camisolo Mine Co. has secured a concession for powers to utilise the flow of the River Troggia in the generation of electrical energy for power purposes. It is estimated that 538 H.P. will be available.

GERMANY.—A municipal electricity works is to be established at Reichenberg near Gorlitz.

Croydon.—The eighth annual report of this municipal undertaking shows a gross profit of £24,683 as compared with £21,058 the year before; the net profit is £6,332. Nearly £35,000 was expended on new buildings, plant and mains, bringing the total capital expenditure to £305,574. The generating expenses were reduced from 1·589d. per unit to 1·444d. A total revenue of £49,675 was derived thus:—Private lighting, £28,128; public lighting, £7,627; tramways, £13,109; other sources, £809. The revenue is an increase of £3,079, and 340 new consumers were added, the additional lamps fixed being equivalent to 17,011 8-C.P., and over 4,840,000 units were generated. The mains laid in the twelvemonth amounted to a length of about 20¼ miles, making the total laid 182 miles. The total capacity of the station prior to the extensions recently carried out was 6,500 H.P., but the station has now been enlarged to allow of the installation of plant which will double this output. A new set of 1,200 H.P. has been installed, bringing the total capacity now up to 7,700 B.H.P. A new chimney, 200 ft. high and 11 ft. internal diameter, has been erected, and the boiler house, which now contains 14 boilers, has been enlarged to allow of the number of boilers also being doubled. Extra office accommodation and a test room have been provided.

Edinburgh.—The T.C. has decided to install 50 additional electric lamps for street lighting.

Erith.—The report on the past year's working of the U.D.C's. electricity undertaking shows a gross profit of £2,024 and a net deficit of £800.

Falkirk.—The Corporation has placed an order with the British Electric Plant Co. for the complete equipment, with electrically-driven plant, of the new gasworks now being erected in Falkirk. Energy will be supplied from the Corporation electricity works.

Fenton.—The *London Gazette* for July 25th contains notice that the B. of T. has revoked the electric lighting order of 1899.

Heavitree.—The U.D.C. has given its assent to the Exeter T.C.'s application for a prov. order empowering the latter to supply energy to Heavitree.

India.—Another instance of a person obtaining a supply of energy from the "free" side of the meter, by placing pins in a cable, was described before the Chief Presidency Magistrate at Calcutta recently. The method adopted to obtain a supply was by the insertion of two pins connecting the main cable leading to the meter with the one from the meter, supplying the premises of the person prosecuted. A fine of 200 rupees and one day's imprisonment was imposed.

Electric Lighting for Bangalore.—The Electrical Department of the Mysore Government states that the new transmission line from Sivasamudram to Bangalore was charged under test on June 28th, for slightly over three-quarters of a hour under full voltage—*i.e.*, 35,000 volts—and the test was successful.

London.—Westminster.—The Works Committee has informed the B. of T. that the covers of the distributing boxes form part of the surface of the public street, and that, therefore, the material which shall be used for the cover is a matter exclusively within the discretion of the Council as the highways authority, and does not come within the jurisdiction of the Board.

London Electric Supply Corporation.—The units sold for the half-year ended June 30th last amounted to 6,130,461 (of which 4,039,970 units were for power purposes), producing a total revenue of £62,886; this compares with 4,494,220 units sold in the corresponding period of 1904, producing £54,776.

South London Electric Supply Corporation.—The company announces that the sales of energy for the quarter ended June 30th amounted to £16,620, against £15,054 for the corresponding quarter of 1904.

Battersea.—The Lighting Committee has reported having had under consideration the question of the lighting of the whole of the Nine Elms Ward by electricity. Several schemes have been prepared by the electrical engineer, and the committee has decided in favour of the following, at a total cost of £15,140. To provide for the extension of the necessary mains for public and private lighting, including arc lamps and the necessary feeder cable from the central station. Estimated cost £14,000, made up as follows: Extension of distributors, £3,300; 30 arc lamps, £930; extension of mains in new road, £700; 15 arc lamps, £465; laying ducts, £1,763; feeder from the central station to the boundary, £6,842.

Bermondsey.—The E.L. Committee has reported that the expenditure on the year's working ending March 31st last was £10,875, and the income £12,016. It has been resolved that from October 1st next the charge for power purposes shall be 1½d. per unit for the first four hours' average daily use of the maximum demand, and ¾d. per unit after.

City.—The Corporation has resolved that the pressure between any pair of terminals situate in cellars or vaults shall not exceed 450 volts, and that the conductors shall be insulated in the best possible manner and encased in a continuous metallic sheathing efficiently connected to earth.

Fulham.—About 400 flats are to be erected in part of the Council's area, and the builders have offered to have them wired, on the condition that the B.C. supplies prepayment meters. The borough electrical engineer favours the adoption of this arrangement. The cost of these meters is, roughly, £1 more each than the ordinary meters, and to meet this additional expense the price of energy will be at the rate of 4d. per unit. As an experiment 25 prepayment meters are to be obtained.

Hackney.—The responses to the invitation issued to electrical contractors to exhibit machinery and apparatus at the proposed borough electrical exhibition were not satisfactory, and it has been decided to abandon the exhibition for the present. Disputes having frequently arisen with consumers whose installations were on the border-line between the two sizes, and the higher meter rent for the larger size installation being sometimes an obstacle in the way of a small consumer slightly increasing his installation, the Committee has gone into the matter, and decided that while the loss to the department would be almost negligible, the consumers would be more satisfied with a uniform rental.

From the beginning of the December quarter the rental for meters has been fixed at the uniform rate of 1s. per meter per quarter.

Islington.—The district auditor, in his report on the accounts for the year ending March 31st last, states that since the last audit the cost of providing and maintaining the public arc lamps has been transferred from the electricity to the general revenue account. The rate per unit for the supply of energy to these lamps, which formerly included the cost of providing and maintaining the lamps, remains unaltered; and the general rate has thus contributed £2,600 in excess of the former rate to the electricity revenue account. The electricity engineer admits that the rate of charge, viz., 3½d. per unit, requires revision. The town clerk, in reply to questions, said that the cost to the borough of opposition this session to the Administrative County of London Bill was £250, the North Metropolitan Supply Bill, £60; and for opposing the North Metropolitan Supply Bill in the House of Commons, the cost altogether up to the present time was £103. If they were going to oppose, by leading counsel and expert witnesses, the costs would amount to £1,000.

Marylebone.—The Central Electric Supply Co., which seeks powers to build a generating station alongside the Regent's Canal in Marylebone, in order to supply electricity direct to that borough, Hampstead, Paddington, Westminster, St. Pancras, Holborn, and adjoining parishes, has come to terms with the Corporation, assenting that electricity generated at the new station should only be supplied through the Westminster and St. James's companies.

The inquiry as to the proposed change of pressure by the Borough Council was resumed on Saturday, when it was stated that the system of testing adopted and used by the B.C. was quite inadequate. The consulting electrical engineer to the Norwich Insurance Co. concurred with this, and said that his experience was that, while the test used was useful, it did not show whether the wires behind walls and under floors, &c., were in an efficient condition to carry the pressure proposed to be placed upon them, and his company, he believed, would not endorse policies until conditions which they would make were complied with. The inquiry was closed, and the evidence is to be submitted to the Board of Trade for its consideration and decision.

Southwark.—The General Purposes, Law and Parliamentary Committee has decided to hold a conference with the E.L. Committee with respect to the offer of the County of London Electric Supply Co. to either supply the Council with energy in bulk or to take over the undertaking on lease.

Loughborough.—On the recommendation of the borough electrical engineer, the T.C. has decided to reduce the price of energy to the following:—Private house and shop lighting, 4d. per unit; factory and workshop lighting in bulk, 3d.; energy for motors, &c., between 5 p.m. and 11 p.m., 3d.; and for other hours 1d. per unit. These reductions are to be in operation as from July 1st, 1905.

Macclesfield.—A site is to be purchased in Green Street for the erection of electricity works. The consulting electrical engineer has submitted a scheme, and after considerable discussion it was adopted, and the committee decided to apply for sanction to borrow £16,000 to carry out the undertaking, the principal items of expenditure being: Buildings, &c., £3,500; plant, £7,500; mains, £3,500; connections, £600, and contingencies, £900.

Maidstone.—Mr. E. E. Hoadley, the borough electrical engineer, in his report of the past and third year's working of the electricity undertaking, states that after paying interest and sinking fund charges, there remains a net profit of £466. During the year the lighting of the tramway route by 16 arc and 12 Nernst lamps was carried out. We give below comparative figures which will show the progress made in connection with this undertaking:—

	1905.	1904.
Total revenue	£9,222	£6,288
Works and distribution costs	4,662	3,780
Interest and sinking fund charges	4,094	3,783
Balance	+ 466	− 1,275
Average price obtained per unit	2·67d.	3·01d.
Working costs per unit	1·42d.	1·91d.
Total units sold, including 141,122 for traction in 1905	783,279	474,273
Capital expended	£58,981	£54,632

Malton.—The U.D.C. has accepted the offer of the Northern Counties Electricity Co. for public lighting at £357 per annum.

Norton.—The U.D.C. on Monday decided to waive their right to the provision of a generating station in the town by the Northern Counties Electricity Supply Co., and as a result the laying of cables from Malton will be proceeded with at once.

Ossett.—A ratepayers' meeting was held recently to consider the electric lighting scheme for the borough. A resolution was passed, requesting the Council to abandon the present scheme, and to obtain further extension of time to carry out the prov. order.

Portsmouth.—The past year's working of the electricity undertaking has resulted in a net profit of £5,100; this has been added to the reserve fund, which now amounts to £16,825.

Provisional Orders.—Application is to be made for E.L. powers for the following districts as under, and the local authorities have been notified by the applicants:—

Cirencester.—The Cirencester Electric Supply Co.

Eton R.D.C.—(Parishes of Burnham, Farnham Royal, Fulmer, Horton, Iver, Langley Marish, Stoke Poges and Wrexham).—The Slough and Dachet Electric Supply Co., and for Hedgerley and the same parishes (except Burnham), the Uxbridge and District Electric Supply Co.

Farnborough.—The United Electric Construction Syndicate.

Honiton.—Messrs. J. & W. Purves, of Exeter.

Maryport.—The British Electrical Engineering Co. and Messrs. Foote & Milne.

Pwllheli.—Mr. W. Emmott, of Halifax. The Council has informed Mr. Emmott that it is prepared to negotiate for the sale of its prov. order.

Radstock.—The Radstock and District Electric Supply Co.

Truro.—Messrs. Seymour, Williams & Co., of Parliament Street, S.W.

Rawtenstall.—The T.C. has applied to the L.G.B. for sanction to a loan of £12,000 for carrying out the E.L. scheme.

Rugby.—A L.G.B. inquiry was held on July 19th relative to the application of the U.D.C. for a loan of £2,000 for E.L. purposes. There was no opposition.

South Africa.—Rand Mining.—The annual report of the Crown Reef Gold Mining Co., Ltd., states that the value of the electric power and lighting plant is estimated at £13,000.

Port Elizabeth.—On the 28th ult., the Mayor laid the foundation stone of the new electric power station which it is expected will light the town within 12 months.

South America.—The Esperanza Municipality has accepted the tender of Messrs. Juan Carosio & Co. for the installation of an electric light station for the sum of $28,200 gold. The installation will consist of 38 arc and 800 incandescent lamps. The plant will be working in January next.

Taunton.—The T.C. has applied for a loan of £4,844 for E.L. purposes.

Tiverton.—The borough surveyor has ascertained from the L.G.B. that it is not adverse to the T.C.'s E.L. scheme, but cannot sanction the loan whilst the terms of the proposed three years' lease to the contractors stand as drawn, the ratepayers not being sufficiently protected.

Torquay.—Concerning the question of erecting a new station in the town, or extending the present one, it appears that on several occasions recently the directors of the Dolter Electric Traction Co. have discussed the matter with their engineers. These have examined the plant at the present station, and are of opinion that it is possible, by rearrangement and slight additions, to supply, at least, power for the first section without interfering with the supply for lighting and power. The company suggests that its engineers and Mr. P. Storey, the borough electrical engineer, discuss this scheme. The company guarantees that the Corporation shall be put to no expense in the matter. The company is further prepared to lease the existing lighting undertaking and pay interest and sinking fund and share profits by an equitable arrangement with the Corporation; and, in the event of this proposal not being entertained, it suggests that perhaps the Corporation would be prepared to sell the undertaking. Should it be found impossible to obtain sanction to the loan of £42,000 from the L.G.B. to construct the proposed new power station, and also impossible to make arrangements for the additional supply of energy from the present station, the company intimates that it will be prepared to consider the question of providing its own station, on condition that the first lines to be laid shall be from Torquay railway station to Torre station, *vid* Torbay Road, and also that it will not be required to place the car-sheds on the Corporation site, and shall also have the advantage of several minor points in construction, which, however, it claims will be as advantageous to the town as to the company. It has been arranged to accept the offer of the Dolter Co. for a consultation with the borough electrical engineer on the scheme of extension of the present station, the approximate cost of which is estimated not to exceed £6,000.

Willesden.—The resident electrical engineer has submitted a scheme for incandescent electric lighting in place of incandescent gas lighting in side streets without any increase in cost. A sub-committee is to visit other districts in which the first-named is used, to obtain full information.

TRAMWAY AND RAILWAY NOTES.

Accidents on Electric Railways.—In the annual general report on railway accidents in the United Kingdom, issued a few days ago, a table is inserted which gives the number of persons killed and injured in 1904 through coming in contact with "live" rails on the Lancashire and Yorkshire and North-Eastern Railways. The total deaths amounted to eight, there being four on each line, and the number injured to 20, four of whom were injured on the Lancashire and Yorkshire and 16 on the North-Eastern line. In addition, 12 servants of the companies named were injured by electric shocks and burns not caused by *direct* contact with the live rail. Through actual contact one railway servant was killed and seven injured on the North-Eastern Railway, and two were injured on the Lancashire and Yorkshire Railway. Both lines were fairly fatal to trespassers, three being killed and six injured on the North-Eastern system, and four killed and two injured on the Lancashire and Yorkshire. In addition, three persons "on business" were injured near Newcastle.

Chili.—The *Financial Times* says that on the 19th inst., at Berlin, at the meeting of the Deutsche-Uberseeische Electric Co., the management submitted a motion to increase the capital by some 17 million to 36 million marks, the intention being to acquire the Chilian Electric Tramway and Light Co. at Santiago. The chairman stated that the company receives in exchange for 9,768,000 marks in stock £598,738 in 6 per cent. preference shares of the Chilian Co. quoted at 80 per cent., and, in addition, £386,000 in ordinary shares of the same company gratis. The company will have power to appoint two members on the board of the Chilian Co. The management of the Chilian Co. has hitherto been in the hands of Messrs. Wernher Beit & Co., of London.

Colombo.—*Indian Engineering* states that the Colombo Electric Tramways Co. proposes shortly to reconstruct the whole of its tramways.

East Ham.—The accounts of the tramway undertaking for the past year were submitted to the Council meeting on Tuesday, and showed a net profit of £2,612. This amount is to be placed to the credit of the reserve fund. A letter was considered from the Barking Council, stating that it was prepared to grant a lease of its tramway track from the eastern boundary of the borough to Ripple Road for seven years, subject to the same being cancelled in the event of any extension being made.

Edinburgh and Queensferry.—The inquiry before the Parliamentary Commissioners in regard to the Edinburgh and Queensferry Electric Tramways provisional order was resumed on Monday. At the conclusion of the evidence the Commissioners threw out the order altogether, thus holding that no case had been made out for the Tramway Co.

Greenock.—The appeal by the Greenock and Port Glasgow Tramways Department against the decision of the Board of Trade arbiter, on the question of the proportion of profits due to the Corporation of Greenock, has been withdrawn. The Corporation will thus receive the £600 awarded by the arbiter with interest on the sum of £1,500 set aside each year for depreciation.

Hastings.—The B. of T. inspection of the Hastings tramways took place last week; it is understood that the results were satisfactory, and in the course of about a fortnight the system will be opened to the public.

Leeds.—The Corporation is taking a pioneer move in regard to motor-cars for the use of the staff and members of Committees whilst engaged in their municipal duties. In addition to the two cars in use for the Tramways Committee, and one for the Highways Committee, two motor-'buses are to be delivered shortly, and orders have been placed for a couple of Belsize motor-cars, fitted with four-cylinder engines, and developing about 40 H.P. A motor-van for the conveyance of goods will also be obtained. The Tramways Committee has in use a motor-driven derrick. A special motor-car department will be provided for these nine vehicles, and all repairs executed by the Corporation mechanics. Each Committee will pay for the hire of the motor-cars, and it is estimated that a considerable saving of the ratepayers' money will be effected by the new departure.

Liverpool-Southport Railway.—On Wednesday last week, when the train which left Liverpool about 9.30 a.m. was nearing Bootle, a motor under one of the carriages failed, and a short circuit being set up the carriage caught fire. Fortunately, the occurrence took place at a time when the traffic from Liverpool is not heavy. The flames were extinguished by the officials before much damage was done, and the traffic was not much delayed.

London.—At the meeting of the L.C.C. held on Tuesday, the question of providing improved brakes and increasing the speed of the cars was referred to by the Highways Committee, which stated that it had asked the Board of Trade whether the department would revise the speeds at present allowed of from 4 to 12 miles an hour, and increase them to 16 miles an hour. It appeared that the Board would probably be willing to do so, subject to first obtaining the views of the local authorities and the Commissioner of Police, and the Board had arranged to communicate with those authorities in regard to the matter, while the Committee had also approached the Commissioner of Police on the subject. Experiments had been made with electro-magnetic track brakes, and the Westinghouse and British Thomson-Houston appeared to give very satisfactory results. The Committee therefore suggested that the sum of £3,500 should be expended for the equipment of the Streatham cars to the extent of 50 cars with the Westinghouse type, and 10 cars with the B.T.H. type of brake. In the opinion of the Committee, the increase in speed would result in a considerable addition to the receipts, and there would not be any appreciable rise in the running expenses. The cost of equipping the remaining 340 cars on the southern lines would be £21,000, but the Committee proposed to report on this point when the results obtained from the use of air-brakes had been considered. The Committee also proposed to expend £4,500 to form an additional junction at St. George's Circus, so as to provide an alternative route to the Elephant and Castle *via* Borough Road, Lancaster Street, Southwark Bridge Road and Newington Causeway, and £1,025 on the construction of additional passing places.

The Highways Committee further reported that complaints had been received as to the noise caused by the running of tramcars on the Tooting section. It appeared that the rail joints had in many cases worked loose, and in order to remedy the defect it was proposed to make a trial of the Thermit system of welding the joints. Arrangements had therefore been made for 200 rail joints to be welded on that system at a total cost of £240.

The Highways Committee submitted several recommendations which were adjourned for a week in compliance with the Standing Orders. In the first report the Committee stated that the arrangements in connection with the equipment of the Strand-Southampton Row subway were well in hand, and the question of utilising the subway for tramway traffic as soon as practicable had received consideration. As the construction of the tramways in Rosebery Avenue and St. John Street Road would soon be completed, attention had been paid to the matter of providing for a through tramway route from the Strand to the Angel *via* the tramway subway, Theobald's Road and the new line in Rosebery Avenue and St. John Street Road. The North Metropolitan Tramways Co. had expressed its willingness to allow the Council to reconstruct the lines in Theobald's Road, subject to the payment of reasonable compensation in respect of the suspension or dislocation of traffic which would thereby be caused. After the completion of the work the company's cars would use the Theobald's Road tramway in common with the electric cars running from the Strand to the Angel, the company having agreed to the proposal. In these circumstances

the Committee asked the Council to approve an estimate of £59,394 for the provision of cars, trackwork, cables, switchboards, &c. It was proposed to obtain a supply of power from a temporary source pending the completion of the Greenwich station. The second recommendation referred to a proposed expenditure of £37,810 in respect of the rebuilding of the car-shed at Jew's Row, Wandsworth, and £15,820 for the erection of sub-stations at Battersea and Wandsworth in connection with the tramways in those districts. In the third place, the Committee asked for authority to expend £30,000 for the construction of the foundations and erection of the chimney for the second portion of the Greenwich station. The fourth recommendation was in favour of the revival in the next session of the Tramways Bill recently thrown out by the House of Lords for the construction of lines over Westminster and Blackfriars Bridges and in other districts, while the fifth related to the promotion of powers to authorise the construction of loop lines in Curtain Road and Harwar Street as alternative routes to single line sections of the existing tramways in Old Street and Kingsland Road.

Universal condemnation of the action of the House of Lords in throwing out the Council's Bill for constructing tramways across the bridges, and for other tramway matters, has been expressed by numerous public bodies, by the Press, and by members of both Houses of Parliament. The Highways Committee of the L.C.C. has recommended the Council to reintroduce the Bill in the next session in its entirety, and has coupled with the recommendation a vigorous protest against the rejection of the Bill, a proceeding which undoubtedly was absolutely contrary to the public weal.

Hackney.—The Works Committee reported on Monday having had before it the views of a deputation from the Leyton U.D.C. in favour of the opposition to the proposed L.C.C. trams being withdrawn, and also a memorial from residents of Lea Bridge Road, objecting to the adoption of the overhead system of traction in that thoroughfare. The Committee had decided to adhere to the principles of the resolution arrived at in October, 1903, strenuously opposing any adoption of the overhead trolley system for the working of tramways within the Borough of Hackney.

Mexico.—A concession has been granted for the construction and working of an electric railway between Guadalajara and Chamela.

New York City.—The extensions of the New York subway system were opened for the first time for passenger traffic on July 10th, and it is now possible to travel, for a single 5 cent fare, all the way from the Battery, at the extreme south end of the Island of Manhattan, to 190th Street in Bronx Park, a distance of about 14 miles. The journey, however, will not be continuous until every part of the line has been perfected, passengers having to change cars at Harlem. Generally speaking, above Harlem the "subway" is above the street level. Large ventilating fans are being installed at various points in the underground portion of the line for the purpose of exhausting the foul air which accumulates, and which has led to a considerable falling-off of traffic during the hot weather. The larger of these fans will exhaust 60,000 cb. ft. of air per minute.

North-Eastern Railway.—After having for some weeks conducted a series of experiments with Barton limestone, from one of the Teesdale quarries, in the neighbourhood of Darlington, for the purpose of using it as ballast on the Tyneside electric lines, the North-Eastern Railway Co. has now commenced experimenting with slag from the Cleveland steel works. Blast furnace slag, of which there is an enormous quantity in the vicinity of Middlesbro', is stated to be one of the most perfect non-conductors in existence, and, if used in substitution for the coke breeze now so generally employed for ballast on British railways, should minimise to a great extent the dangers of electric shock. The advantages claimed to be derived from the employment of blast furnace slag, in addition to its non-conducting power, are its freedom from dust, the comparatively low cost at which it can be obtained, and its self-draining properties.

North London.—With the opening last week of the section of the tramway system connecting Finsbury Park and Stamford Hill with Lower Edmonton, the electrification of the whole of the 8½ miles of tramways in Middlesex acquired by the Metropolitan Electric Tramways, Ltd., from the North Metropolitan Tramway Co., has been completed.

Poole.—The T.C. has applied to the B. of T. for an extension of time of two years in which to construct the tramways through Parkstone. Provided Branksome U.D.C. consents, Bournemouth T.C. will be asked if it is willing to undertake the construction of the line, and also of the projected line to Sandbanks.

Portsmouth. — The balance-sheet of the Corporation electric tramways for the year ended March last shows the total receipts to be £100,973, the gross profit £56,807, and the net profit £21,959. After paying out of the revenue for permanent improvements, a balance of £14,000 is left.

Potteries.—At Stoke-on-Trent last week, Col. Boughey, R.E., and Mr. H. A. Steward, of the Light Railway Commission, and Mr. A. D. Erskine, secretary to the Commissioners, held an inquiry with respect to an application by the North Staffordshire Railway Co. for an order authorising them to work 12 mineral branches of their system as light railways. The Potteries Electric Traction Co. opposed the application. Mr. W. D. Phillips, general manager of the North Staffordshire Railway, stated that the application had reference to certain short branch lines over which the company at present ran goods and mineral trains only. If the application were granted it would enable the company to meet a very general want in the district in respect of the carriage of passengers at a moderate expenditure of capital. It was intended to work the branches with self-propelled rail motors, driven by steam, petrol or electricity, whichever might ultimately be found best. They would carry 40 to 60 passengers, and stop at any road crossing or bridge where passengers were likely to wish to alight or to join the car. For the tramways company it was contended that they were providing adequate means of transit for the public in the districts covered, and that the proposed light railways would act in direct competition with the tramways. After a long inquiry the Commissioners announced that they were prepared to submit an order to the B. of T. sanctioning the working of all the lines as light railways, except three.

Shildon.—The U.D.C. has decided to oppose the application of the United Kingdom Tramways and Light Railway Syndicate for an extension of time until August, 1906, for constructing the tramways, unless the company pays the Council a wayleave of £50 per mile per annum.

Tipton.—The difficulties which have for some time existed between the U.D.C. and the Tramway Co. respecting the reconstruction and equipment of the lines in the Council's district have at length been satisfactorily adjusted. The company is now prepared at once to equip the stage from Dudley to Five Ways, Tipton, and also the stage from Wednesbury to Ocker Hill, and to pay the expense incurred up to the present time. The only point remaining for settlement is the desire of the Tipton U.D.C. to get the Tramway Co. to equip a twopenny stage, viz., from Dudley to Princes End, instead of a penny stage from Dudley to Tipton only, but that will no doubt be also arranged. It is also stated that little or no difficulty will be experienced in respect of the reconstruction of that portion of the tram line between Ocker Hill and Princes End, owing to the continued subsidence of the road.

Tyneside Electric Railway.—The overcrowded and hot condition of the carriages on the North-Eastern Railway Co.'s electrified section has given rise to a number of complaints. The increase in the traffic during the holiday season, and the hot weather, have combined to produce this result, many passengers being obliged to stand in the gangways.

West Ham.—At the meeting of the Corporation on Tuesday, the accounts of the tramway undertaking for the year ending March 31st last were submitted. The capital expenditure for the 12 months under review was £145,322, making a total under this head of £288,344. The gross revenue was £61,748, the revenue from the Council's own cars being £56,194, and the estimated profit due from the North Metropolitan Tramway Co. in respect of the horse cars worked by them on behalf of the Council being £5,550. The total expenses were £38,932, and after payment of interest, contribution to sinking fund (£4,325), and amounts appropriated to reserve or renewal fund (£3,092), there remained £7,076, of which it was proposed to transfer £7,000 to the borough fund in relief of the rates. The traffic expenses amounted to 3·738d. per car-mile; the largest item under this head was wages of drivers and conductors, which absorbed 2·428d. per car-mile; general expenses amounted to ·985d. per car-mile; repairs and maintenance came to ·729d. per car-mile; and the purchase of energy to 1·697d. per car-mile.

Woking.—The Light Railway Commissioners have intimated that the application of the West Surrey Light Railway Co., Ltd., for the Woking and Bagshot Light Railway (Extension) Order will be granted.

The Barton-Rawson Airship.—The first public ascent of this airship took place on Saturday last from the grounds of the Alexandra Palace. The airship consists of a balloon, some 180 ft. in length, and 40 ft. in diameter, from which is suspended a bamboo frame car, 127 ft. long, and with a deck of varying width extending over the greater portion of its length. At either end of the deck are arranged two 50-h.p. Buchet four-cylinder petrol motors; the latter are each connected by belts to two 7 ft. diameter air propellers, arranged on either side of the ship, and running at a speed of 1,000 r.p.m. A suitable rudder and movable aeroplanes are provided for directing the motion of the ship. The total weight of the ship is stated to be some 6½ tons. To say that the spectators of Saturday's performance were disappointed, would scarcely be correct; in all probability their anticipations were for the most part realised, and the fact that the balloon travelled along steadily with the easterly beeze, which on *terra firma* appeared to be of very moderate strength, excited scarcely any comment. We have heard that the navigators intended to circle round St. Paul's, returning at their leisure to the starting point in the Alexandra Palace grounds, a somewhat similar performance to that actually accomplished by Captains Renard and Krebs, in Paris, in the year 1884, with an electrically-driven aerostat of similar appearance, which was described and illustrated in the Electrical Review of September 20th, of that year; but be that as it may, they landed or were deposited ultimately at Romford, after an hour's voyage. Divested of its romantic halo, and even though deserving of Dr. Barton's satisfied testimony as to its performance, this latest airship does not impress one as being within the region of practical utility. From a constructive point of view, it was clearly unsuited to such primitive methods of egress from its shelter as were adopted on Saturday, and equally so to the descent, which, although on a selected spot, ended so disastrously to its structure.

THE FISHER STREET SUB-STATION OF THE METROPOLITAN ELECTRIC SUPPLY CO., Ltd.

In our issues of November 13th and 17th of last year, we referred at some length to recent developments which had occurred in connection with Metropolitan Electric Supply Co.'s installations.

We then described in detail the plant installed in that company's North Street and Tower Street sub-stations, and the 10,000-volt two-phase transmission at 60 cycles, connecting these sub-stations with the Willesden power station.

The Fisher Street sub-station, which forms the subject of the present article, is a more recent addition to the company's installations; it having been built to replace the old Sardinia Street generating station, acquired by the L.C.C. in connection with street improvement schemes in the latter neighbourhood.

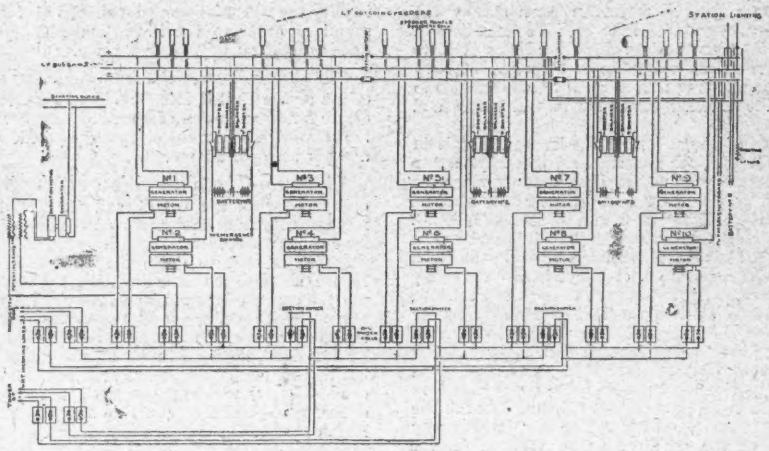


Fig. 1.—Key Diagram of Electrical Connections, Fisher Street Sub-Station.

The high tension voltage used by this company is, in a sense, the highest to be found in the United Kingdom. 10,000 volts on each of the two phases, with one end of each phase earthed, gives over 14,000 volts between the unearthed conductors, and a voltage to earth corresponding to 17,000 volts three-phase, with earthed neutral.

On the other hand, the direct current voltage is unusually low, the system of distribution being three-wire with 100-volt lamps, calling for a pressure across the outers at the sub-station, varying from 220 to 250 volts. Thus the input is of an unusually high voltage, and the output is an unusually large current.

The station has been laid out for an eventual capacity of 10 500-kw. motor-generator sets, three three-wire storage batteries, three combined balancer booster equipments, and two starting machines.

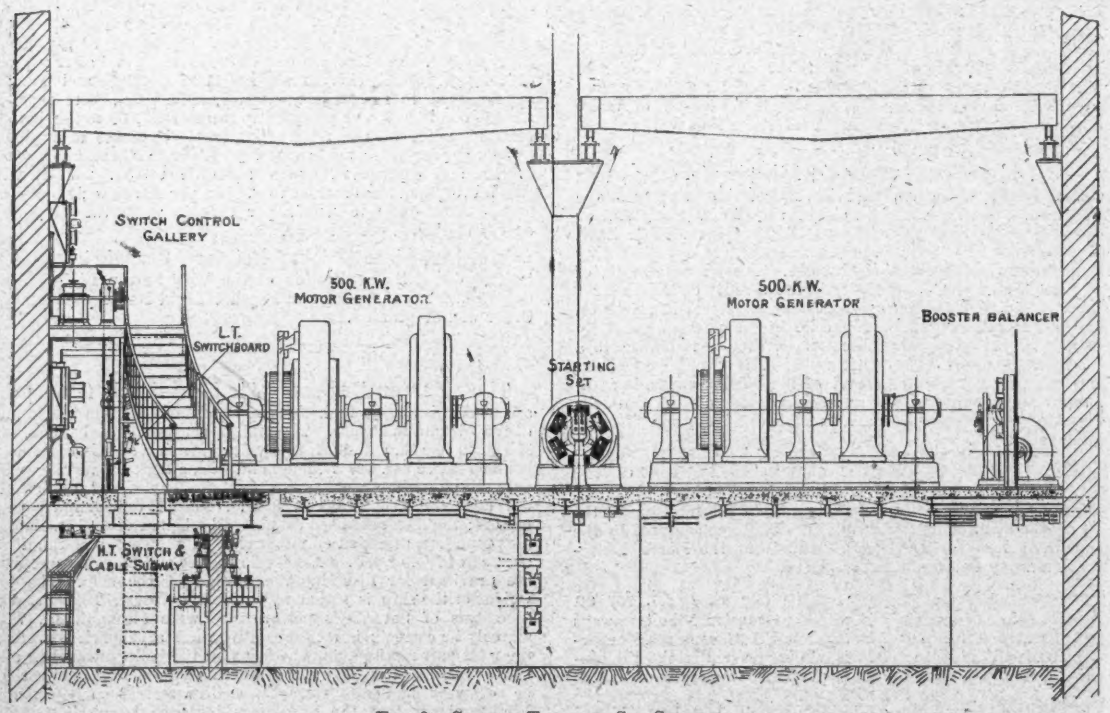


Fig. 2.—Section Through Sub-Station.

The new building is large and airy, consisting of a large machine room in two bays, with a, comparatively, equally large battery room overhead.

A spacious basement contains the H.T. switches and cable connections, and suitable office accommodation is provided at one side of the main building, a cross-section through which is shown in fig. 2.

Of this plant, some six motor-generator sets, supplied by Messrs. Dick, Kerr & Co., are at present installed; these consist of 750-H.P. 36-pole two-phase synchronous motors, operating at 10,000 volts and 60 cycles, and direct coupled to 500 KW, 10-pole shunt-wound generators, giving 2,500

amperes at a pressure of 200 volts, and at a speed of 200 r.p.m.

The two concentric cables carrying the H.T. current to each synchronous motor, end in a special cable box which is bolted to the frame, and from the machine four terminals are carried to the switchboard. The stators of the motors are built up on a strong cast-iron frame supporting the iron laminations, the winding being carried in rectangular open slots, in which the coils are held in position by wedges.

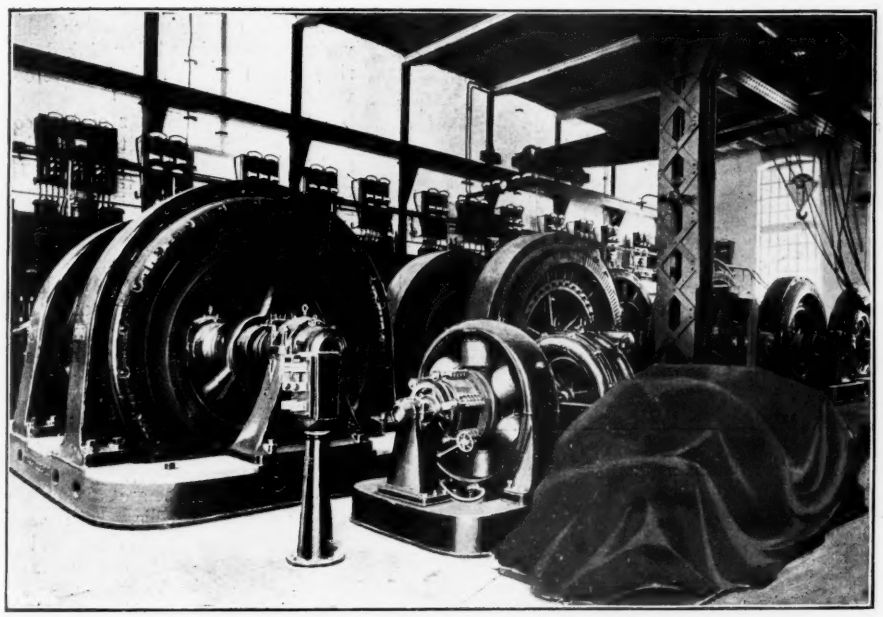


Fig 3.—View of Sub-Station, Showing Arrangement of Plant.

Damping rings are not provided on the poles, but the field coils are supported in spools with solid brass flanges, the winding being composed of edge-wound copper strips, insulated by means of a special fibrous material, the outside being left bare.

The voltage of the exciting circuit is 220, and a variation of the excitation voltage can be obtained by means of a rheostat in series with the field.

The commercial efficiency of the machines is as high as 95·2 per cent. at full load, including rheostat and friction losses, and owing to the excellent ventilation, very low temperature rises occur.

This plant is illustrated in figs. 3, 4 and 6, the first of which also gives a good idea of the location of the switchgear.

In the battery room, fig. 5, two batteries are completed and working, while the third is in course of erection; each contains 110 cells. Of these batteries the first, supplied by the Chloride Electrical Storage Co., has an output of 1,500 amperes during 3 hours, or 3,200 on a one-hour discharge; the second and third of the E.P.S. type, are rated at 1,480, and 1,200 amperes for 3 hours, and 3,000 and 2,000 amperes for 1 hour discharge, respectively. Working in connection with the batteries will be the balancer booster equipments, which have been supplied by Messrs. Dick, Kerr & Co. Each of these sets consists of four machines direct coupled, mounted on one bedplate, with three bearings. The boosters are capable of dealing continuously with a current of 1,200 amperes in each machine, with a maximum pressure of 35 volts. They are also capable of dealing with a steady current of 3,000 amperes for 1 hour without sparking or injurious heating, and will carry an overload of 25 per cent. for that time. A view of one of the latter sets, together with certain switchgear, is shown in fig. 7.

The feature of the installation is undoubtedly the switchgear, which was designed to the specification of Mr. J. S. Highfield, the chief engineer to the company, and was constructed and erected by the British Thomson-Houston Co. This consists of a main low tension board, running the length of the station, a gallery above, filled with instrument panels, rheostats, control handles, &c., and a subway immediately below containing the extra high tension gear; in addition there are various incoming line equipments, booster panels, balancer starting gear, a station lighting panel, &c., arranged

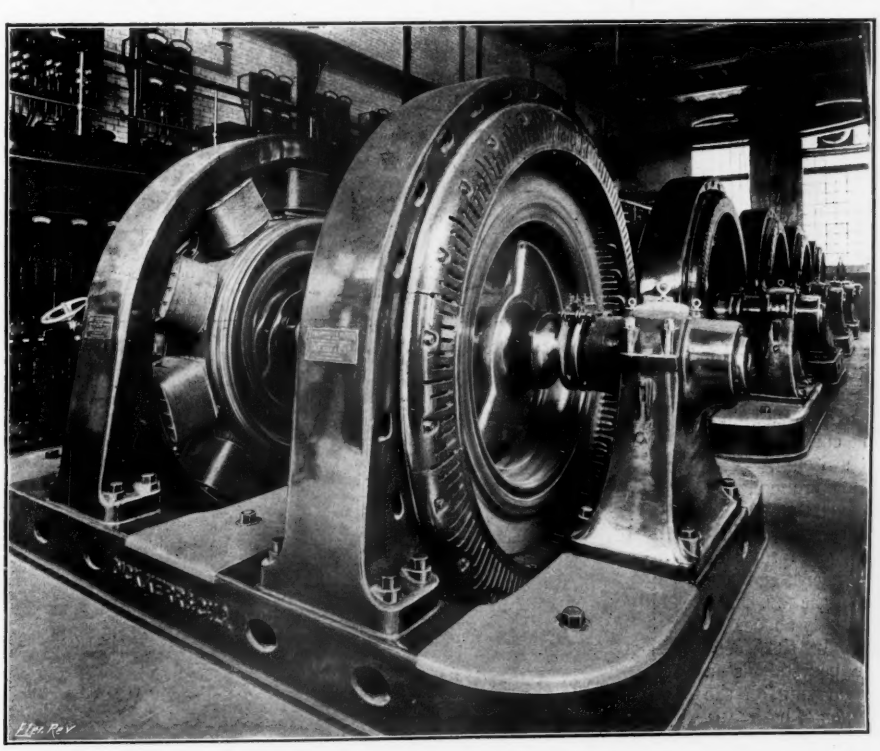


Fig. 4.—View of 500-kw. Dick-Kerr Motor-Generators.

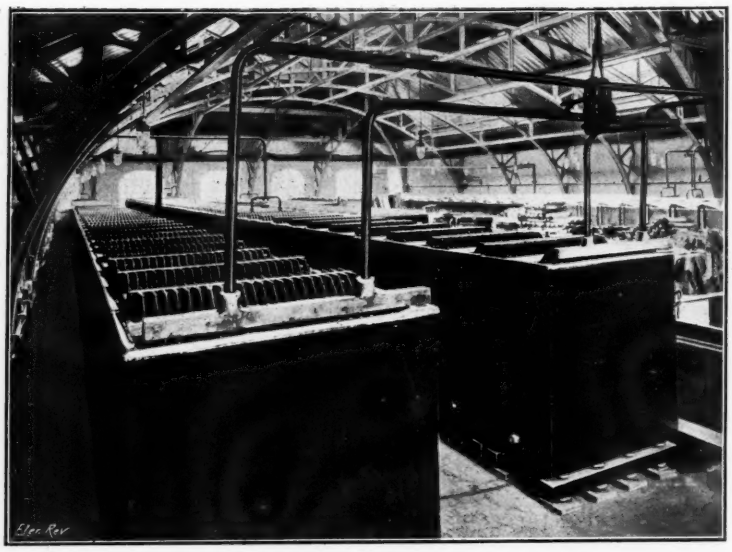


Fig. 5.—Chloride and E.P.S. Batteries in Battery Room.

at points convenient to the corresponding machines or circuits.

The most striking feature of this switchgear as a whole is the arrangement by which both machines, constituting a motor-generator set, are handled entirely by remote control from one position.

In the gallery, (fig. 8) opposite each motor-generator set, there is mounted a pedestal provided with handles for mechanically operating all the switches normally used in handling the set. These are the extra high-tension switches feeding the synchronous motors, and the corresponding direct current generator switches, both of which are mounted approximately opposite their respective machines; the former in the basement, and the latter on the L.T. board immediately above.

Behind the controller pedestal is a panel carrying all the instruments, both A.C. and D.C., and all small switches, such as field switches, synchronising receptacles, relays, &c., all the alternating current instruments being fed at low voltage from current and potential transformers, shunts, &c.

Taking up the switchgear more in detail, the extra high tension current is received in the sub-station *viâ* four transmission lines, two from each of two other sub-stations; those various sub-stations being linked in a ring system with duplicate lines each way around the ring.

Each such line consists of two concentric cables, one for the red phase and one for the blue phase. The outers of these concentric cables being earthed, are easily controlled by open air knife switches of ordinary low tension type, while the inners are controlled by high voltage single-pole oil break switches, one in each phase. These switches (fig. 11) are arranged for automatic tripping by means of overload relays, energised by current transformers connected in the outers, and each phase of the incoming lines can be tripped independently of the other.

The oil switches are in masonry cells, with steel plate doors, and the oil switch tanks, mechanism, &c., inside are all earthed.

Each of the four transmission lines is equipped with two potential transformers, one on each phase, for the supply of voltmeters on each phase, power factor indicators and recording watt-hour-meters, designed to measure the total station input. Three of the line panels and switch pedestals are shown in fig. 10.

The high tension sub-station bus-bars are made up of concentric cable, the inner core of which is the only dan-

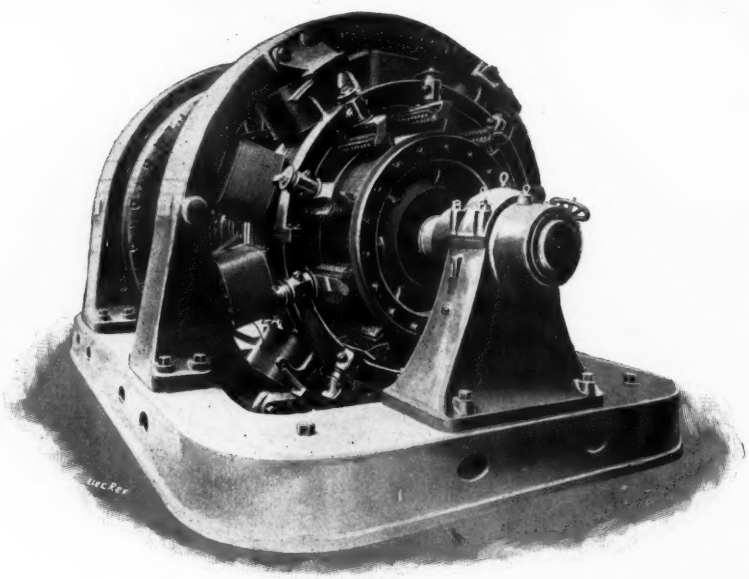


Fig. 6.—500-kw. Motor-generator Unit, D.C. End.

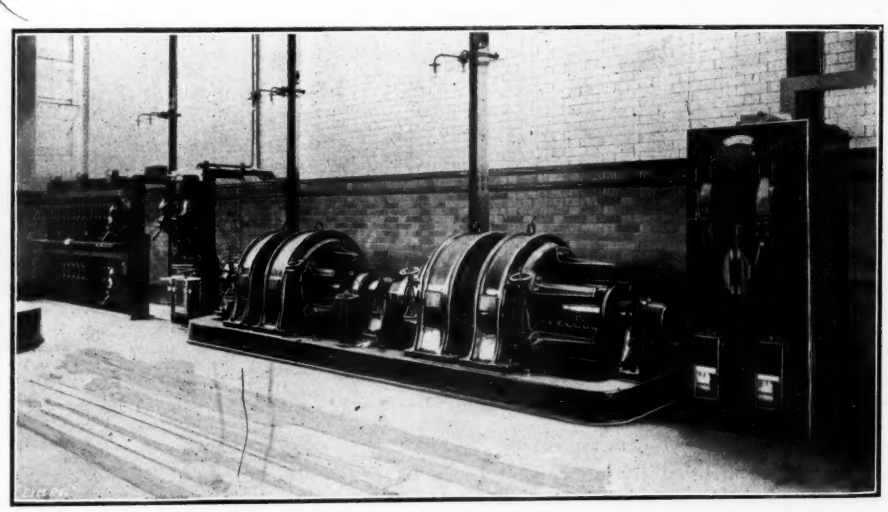


Fig. 7.—Balancer-booster, and Booster Switchgear. Emergency Switchboard to the Left.

gerous conductor, the outer core being of practically earth potential, insulated and surrounded by the usual earthed lead sheath. Tappings are taken into the oil switches in large cable dividing T boxes, mounted on top of the oil switch cells, the inner being carried down directly into the oil switch cells through long corrugated porcelain insulators. No switches are provided for isolating the oil switches from the sub-station bus-bars, but the extra high-tension 'bus is divided by three sets of oil (inner) and knife (outer) switches into four independently fed sections, of which any one can be shut down: see diagram fig. 1.

Fig. 8.—Switch Gallery. Starting Panel (1st) and One Motor-generator Control Gear (2nd) on the Left.

The only points at which the high tension inner conductors are at all exposed, are the terminals of the glass tube fuses used to protect the potential transformers, and these fuses are mounted on their transformers in locked masonry cells.

The extra high-tension gear for each synchronous motor consists of two single-phase oil-break switches in separate masonry cells, with knife switches in the outers; the knife switches are interlocked with the oil switches, so that the former cannot be opened or closed without the latter. In the case of the machines, the current transformers which operate the overload relays are connected in the inners between the machine oil switch and the synchronous motor, the idea being that a breakdown of the insulation of the high-tension winding, to the frame, would cause a heavy rush of current from the power station into that motor, and thence back through earth, which current would not pass through the outer cables or any current transformers in circuit. In this way a certain amount of selective operation is obtained between the machine oil switches and high-tension feeder oil switches, any machine breakdown tending to operate the corresponding machine switches only.

The machine automatics are arranged so that a fault or overload on either phase opens both oil switches on the two phases, differing in this respect from the incoming line automatics. Each synchronous motor is equipped with a potential transformer for synchronising, and for voltage regulation.

The main direct-current low-tension switchboard on the machine room floor is made up of black enamelled slate panels. The lower half of the board is devoted to the negative, and the upper half exclusively to the positive side of the system, the two polarities being isolated by means of a slate shelf extending the length of the board. Each polarity is fitted with duplicate bus-bars, which will be used for running at two voltages.

Each of these bus-bars, which are fixed on the front of the board, has a cross-section of 6 sq. in., and is divided into three sections by means of eight 'bus sectionalising switches, while the feeder panels are distributed between the generator panels. A view of this board is shown in fig. 9, above.

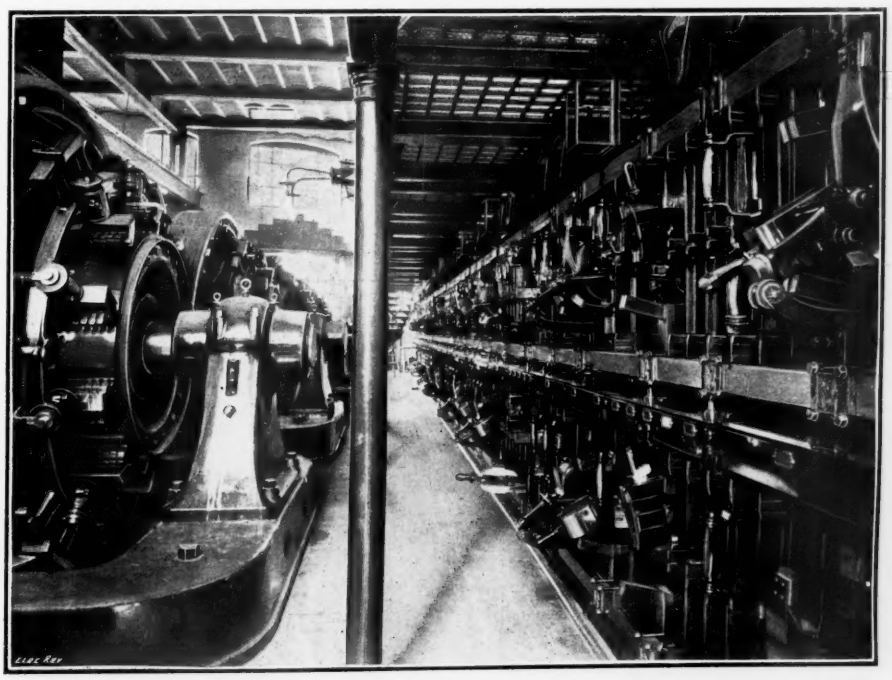


Fig. 9.—View of Main L.T. Switchboard.

Each generator panel is equipped with a watt-hour-

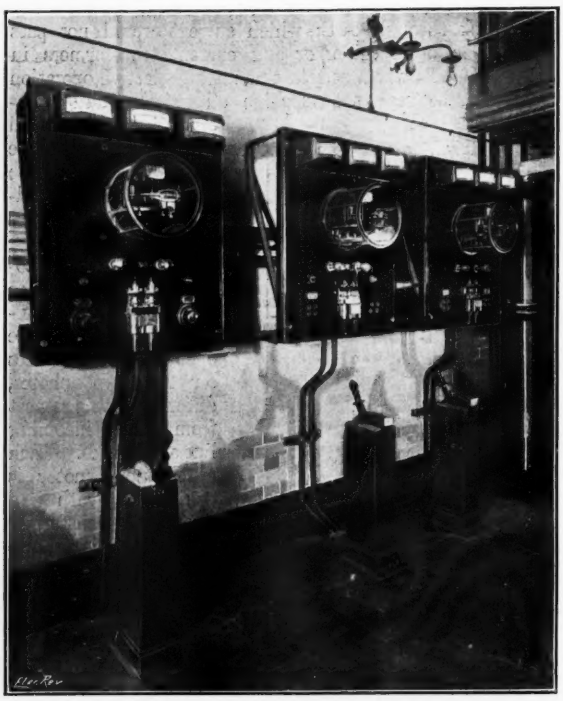


Fig. 10.—Three Incoming Line Panels and Switch Pedestals.

In the main switchboard there are also three battery panels, providing means for connecting the battery to either the high or the low 'bus on each polarity.

The main control of the battery is, however, accomplished at the booster panels, which will be seen located near the boosters in fig. 7. The neutral 'bus is connected to the centre of the battery, enabling the battery to assist in the balance of the system, especially in the case of out-of-balance faults. There are no end-cell switches, all variations of battery voltage being obtained from the balancer boosters, one of the latter being for the positive and one for the negative end of the corresponding battery.

Each booster panel is equipped with three main switches, by means of which the battery can be connected either through the boosters or direct to the bus-bars.

Each battery equipment is designed for a load of 4,000 amperes—*i.e.*, 4 sq. in. of copper have been put in each lead, and each meter, &c., has been designed for the same current, and each equipment includes two watt-hour-meters, one curve-drawing main ammeter, one curve-drawing neutral or out-of-balance ammeter and one curve-drawing voltmeter connected directly across the cells.

The balancers are connected with fields crossed, and each booster is equipped with a series shunt reversing rheostat, with contacts arranged to connect the booster field across any desired voltage, from 125 volts positive to 125 volts negative.

To provide for disconnection of the batteries, the booster panels are equipped with brush toggle switches, with magnetic blow-out auxiliaries, which are capable of clearing the maximum output of a battery on a short-circuit.

meter, an ammeter shunt, a double-throw switch in each polarity, by means of which the machine can be transferred from one set of bus-bars to the other. Each polarity is also equipped with one 3,000-ampere remote operated circuit-breaking switch, handled from the gallery above. The switch of this type on the positive polarity is equipped with a reversal relay, which is set for about 600 amperes, *i.e.*, just sufficient to act as an overload relay when the machine is being started from the D.C. side.

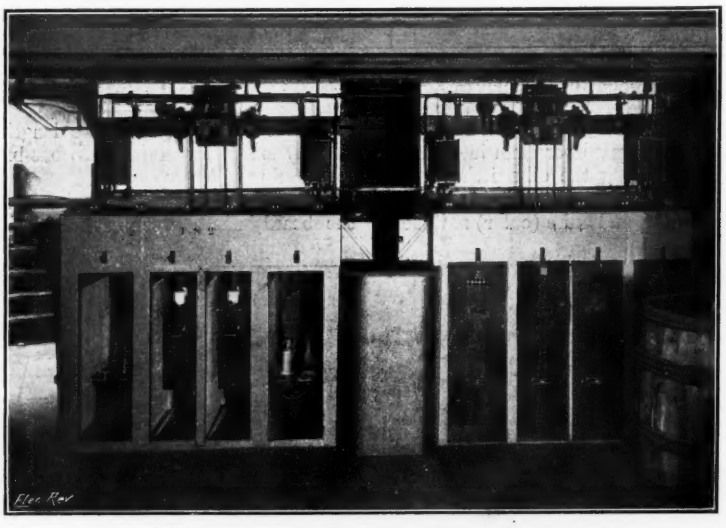


Fig. 11.—Incoming Line Oil Switches.

The 105 direct current feeders for which provision has been made at this station, consist of concentric or triple-concentric lead-covered cables, varying from 1 sq. in. concentric to ·4 sq. in. triple-concentric.

Each feeder is protected by switch fuses, which are made double-throw, so that the feeder can be fed from either the high or the low 'bus.

Each polarity of each feeder is also provided with an ammeter shunt; two ammeters, one positive and one negative, being provided for each five feeders, with suitable swivel switches, so that each ammeter can be connected to any one of five shunts. The outer conductors of the triple-concentric feeders are connected through suitable clamp fittings and screw plugs to a neutral 'bus, which runs along the base of the board near the floor.

Various provisions have been made for starting the motor-generators. As a rule they are started from the direct current bars through a starting box, with an induction motor-generator set as a reserve, in case the D.C. power fails completely. This induction motor-generator set, seen in fig. 3, may be connected on the direct current side to any generator, entirely independent of the main bus-bars.

An addition to the usual starting equipment is a motor-

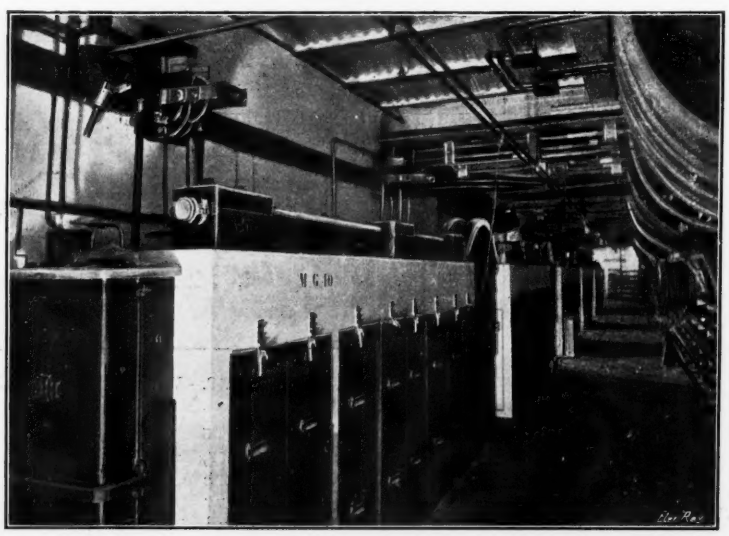


Fig. 12.—Subway under Switchboard, showing Machine Oil Switches and Cable Racks.

driven booster, or, to use a somewhat more explicit term which has been applied to this machine, a depressor. This machine consists of a direct current motor driving a direct current generator, which can be connected in place of the starting box. In the use of this machine the depressor is thrown into circuit with a voltage approximately equal to that across the bus-bars; the depressor voltage is then gradually lowered, thus bringing up the voltage on the unit to be started.

The advantage claimed for this machine is that a unit can be started from rest with about 100 amperes instead of the 400 or 500 amperes usually required when starting through a dead resistance. The starting current runs up as the depressor voltage is lowered, since the depressor returns less of the starting amperes through its motor, as the voltage of its depressing end goes down. As the starting current is much more than the accelerating current, the depressor cuts down considerably the maximum demand for starting.

All of the starting gear has been so designed that current for starting can be taken from any section of the 'bus, either high or low, but no one 'bus or section of a 'bus can be paralleled with any other by any accidental manipulation of the starting switches. Similarly, no standing machine can be thrown in parallel with another up to voltage, through mistakes in the manipulation of the starting switches.

In addition to the instrument panels described on the operating gallery, a bus-bar voltmeter panel and a pilot panel, equipped with six voltmeters for measuring the voltage at the centres of distribution of the network, are also provided, and on the ground floor an emergency feeder board and station lighting board are installed.

The former, seen on the left in fig. 7, is designed for five 1 sq. in. and ten ·5 sq. in. concentric feeders, and a load of 4,000 amperes. Its function is to give an alternative independent supply to the larger consumers, and it is connected direct to the battery, as well as to the main L.T. bus-bars.

The station lighting panel provides for 26 200-volt two-wire and three-wire distribution circuits, fed through a suitable watt-hour-meter.

In conclusion, we wish to express our indebtedness to Mr. J. S. Highfield, chief engineer to the company, for the facilities which he granted us in the preparation of this article.

TELEGRAPH AND TELEPHONE NOTES.

Italy.—The *Gazzetta Officiale* of 11th inst. contains a law sanctioning the expenditure of 90,000 lire (about £3,600) on the erection of a bronze telegraph wire 3 millimetres in diameter between Genoa and Chiasso, on the Italian frontier, to form part of a new direct telegraph line from Genoa to Frankfort-on-Main.—*Standard.*

London. — Westminster. — The Works Committee reported on Tuesday having considered a letter from Mr. J. W. Woods, superintending engineer of Post Office telegraphs, with reference to the Council's refusal to consent to the erection of two test pillars on the public way at Hyde Park Corner, stating that the proposal was part of a scheme for the provision of readily accessible testing points on all main telephone routes at the boundary of the Central Metropolitan engineering district, by which the localisation of faults and the restoration of communication would be greatly facilitated, and the loss of time and obstruction of traffic now associated with the continual opening of surface boxes and manholes in the public way would be avoided. Mr. Woods stated that these testing points had, as far as possible, been placed in the Post Office buildings, and the cable routes had been diverted to the buildings, but where this diversion was not possible, it was decided that the provision of test pillars would be by far the most advantageous arrangement, both for the department and for the local authority. The Committee held that the Telegraph Acts did not authorise the use of the streets in the manner proposed, and that a most objectionable precedent would be established were the Council to consent to the erection of these pillars, and would, no doubt, be followed by numerous applications by electric supply undertakers in the City, inasmuch as a proposal for street pillar boxes in connection with these undertakings had already emanated from the Board of Trade. In the course of time, therefore, enormous obstruction of traffic would be caused. The Committee had decided that Mr. Woods be informed that the Council regretted its inability to consent to the erection of pillars on the public way.

Pacific Cable.—An account relating to the working of the Pacific Cable Act, with the report of the chairman of the Pacific Cable Board, has been published. The report says that the numbers of messages and words transmitted during the year 1904-5 were approximately 177,968 and 2,056,953 respectively, of which 106,782 messages and 1,183,929 words were inter-colonial. The audited traffic figures for 1903-4 amounted to 176,824 messages and 2,097,897 words, of which 108,211 messages and 1,232,928 words were inter-colonial. The actual expenditure of the board on the service of the cable during the 12 months ended March 31st, 1905, amounted to £50,751 11s. 2d., against £54,824 19s. 8d. in the previous year. The total receipts amounted to £87,446 10s. 8d. (including a special item of £5,118 15s. on account of repair services rendered by the *Iris*), against £80,118 13s. 3d. last year. The surplus on actual working was, therefore, £36,694 19s. 6d. The board, however, set aside £35,000 for the renewal fund, and they had also to provide a sum of £77,544 18s. for interest and sinking fund. This sinking fund will extinguish in 50 years the entire capital expenditure. Adding these payments to the expenditure, the deficiency on the year's operations amounts to £75,849 18s. 6d., against £87,751 4s. 5d. in the previous year. This deficiency has to be made good by the contributing Governments. Although, in the year 1904-5, the receipts were swelled by the earnings of the *Iris*, an item which cannot be expected to recur, it is satisfactory to note that the deficiency to be met by the contributing Governments in the second year of the cable's working is less than the annuity due on account of capital.—*Times.*

Roumania.—The Roumanian administration announces officially that the Osteuropaeische Telegraph Co., of Cologne, has completed the laying of the submarine cable between Constantinople and Constanza, and that it was open for the reception of telegrams on the 20th inst. between Germany, Belgium, Denmark, Luxemburg, Holland, Sweden, Norway, Great Britain and Russia, and Turkey and Greece.

Submarine Signalling. — According to the *Daily Graphic*, the experiments carried out by the Cunard steamer, *Lucania*, are favourably reported on by the company. Recently, when making New York in rather thick weather, a Cunard steamer picked up the signals from each of the lightships at Nantucket, Fire Island and Sandy Hook at distances ranging from 2½ to 4 miles, and the captain was thus enabled accurately to check the position of his vessel.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	
Dominica-Martinique	May 7, 1902	
St. Lucia-Martinique	May 7, 1902	
Cayenne-Pinheiro	Aug. 13, 1902	
Paramaribo-Cayenne	May 25, 1905	
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	
Tarifa-Tangier	Jan. 18, 1904	
Closed Vladivostock-Nagasaki	Feb. 9, 1904	
Closed Port Arthur-Chifu	Mar. 9, 1904	
Jamaica-Colon	Jan. 5, 1905	
Bolama-Bissao	June 21, 1905	
Iquique-Antofagasta	July 21, 1905	
Antofagasta-La Serena	July 21, 1905	
Cadiz-Tenerif	July 20, 1905	
Landlines.		
Puerto-Barrios	July 28, 1902	
Kertch-Soutchoum	Sept. 27, 1904	
Alaska landlines	July 10, 1905	
Communication with Brazil *via* Galveston	July 18, 1905	

Telegraph and Telephone Contracts. — In reply to a Parliamentary question by Sir Thomas Dewar, who desired to know the value of the contracts for telegraph and telephone plant respectively given to British and foreign firms respectively for each year during the last three years, Lord Stanley, the Postmaster-General, states: I am unable to divide the amounts between telegraph and telephone plant, as many articles are used in connection with both. The value of the contracts given to British and foreign firms respectively during the last three years was as follows:—

	British.	Foreign.
1902-3	£757,814	£92,740
1903-4	669,985	76,883
1904-5	729,137	228,461

The orders given to foreign firms included respectively £83,676, £69,802, and £220,054 for telephone apparatus, mostly required for equipping exchanges worked on the central battery system, for which the principal patents are held by foreign firms.—*Daily News.*

"Viâ Eastern."—The Eastern Telegraph Co. notifies the following reduced rates per word for telegrams forwarded from Great Britain "*via* Eastern" on and after the 1st prox.:—India and Burmah, 2s.; Ceylon, 2s. 1d.; Cyprus, 1s.; Egypt-Alexandria and all offices in first region, 1s.; ditto second region, 1s. 1d.; ditto third region, including the Soudan, 1s. 4d.; Suakim, 1s. 4d.; Aden, 2s.; Perim, 2s.; Obock, 2s. 1d.; Djibouti, 2s. 3d.; Assab, 2s. 1d.; Massowah, &c., 2s. 2d.; Abyssinia, 2s. 3d.; Yemen, 2s. 7d.

Wireless Telegraphy.—Negotiations have now been completed for the erection of a wireless telegraph station at Machrihanish for direct communication with America. The National Electric Signalling Co., of Pittsburg, has leased about 6 acres of ground at Uread Point, below Lossit Park, for the purpose of an experimental station, and a tower 400 ft. high will be erected.

A return has been published relating to the working of the Wireless Telegraphy Act for the first three months of the present year. The following figures are given:—No. of messages under the terms of the arrangement with the Marconi Co.

handed to the Post Office for transmission to ships at sea, 111; failed to be delivered, 21; messages received from ships at sea and delivered by the Post Office to the general public, 1,655.

The following figures relate to the financial side of the messages:—

	£	s.	d.
Received by the Post Office for outward messages ...	55	2	6
Proportion due to Post Office	7	15	1½
Due to the Marconi Co.	47	7	4½
Received by the Post Office for inward messages ...	65	1	2

Details are also given of the applications for licences. In all there were 73 applications, and in 48 cases permission has been given or is about to be given. Ten applications are still being considered, nine have not been proceeded with, one was entirely refused, another partly refused, and in four cases the applications were refused, but alternative sites were offered.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dudley.—July 29th. Supply of oils to the Corporation. See "Official Notices" July 14th.

Ebbw Vale.—August 5th. Cables, overhead lines, street lamps and fittings, and meters, for the U.D.C. See "Official Notices" July 14th.

France.—July 29th. The French Post and Telegraph authorities in Paris are inviting tenders until the 29th inst. for the establishment of an underground telegraph and telephone line between Villejuif and Juvissy-sur-Orge. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris.

France.—August 2nd. The French Post and Telegraph authorities in Paris are inviting tenders until August 2nd for the supply of 30 kilometres of iron tubing, 65 and 80 mm. diameter for pneumatic dispatch tubes. Particulars may be obtained from, and tenders are to be sent to, Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris.

Germany.—The following contracts are at present open:—The Communal Administration of Niedderzwornitz (Saxony), construction of an electric power station, at 130,000 marks. The Communal Administration of Offenbourg (Baden), construction of an electric power station, at 230,000 marks. The Communal Administration of Lentzchlez-Leipzig, construction of an electric power station, at 250,000 marks.

Mussoorie (India).—October 23rd. Supply and erection of steel power pipes, water motors, alternators with exciters, switchboards complete, transformers, induction motors, pumps, workshop machines; also bare copper overhead mains, insulators, and lightning arresters, arc and incandescent lamps, telephone equipment, workshop tools and general stores. See "Official Notices" July 14th.

War Office.—September 1st. Tenders invited for the purchase of surplus boilers, dynamos, &c., at Bermuda, Barbados, St. Helena and Woolwich. See "Official Notices" July 7th.

CLOSED.

Battersea.—The B.C. has accepted the following tenders:—

W. T. Glover & Co., Ltd., cable to connect No. 8 turbo-generator set with the main switchboard	£88 15 11
Glenfield & Kennedy, Ltd., one new pattern 4-in. hot water meter with brass lined cylinder	55 10 0
General Electric Co., Ltd., Aron watt-hour-meter for No. 8 machine	27 0 0
Mather & Platt, Ltd., electric pump and pipes in connection with the condensing plant	1,600 0 0

Brighton.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for coal handling plant for the Southwick Electric Power Station, at £1,966.

Bristol.—The Bristol Tramways & Carriage Co., Ltd., has renewed its contract with the Sunbeam Lamp Co., for the supply of traction lamps in the next twelve months.

Cardiff.—The Asylum Committee on July 20th accepted the tender of Messrs. D. Forth & Co., of Manchester, for the installation of the electric light at Whitchurch Asylum, at £6,293.

Cardiff.—The Electric Committee on Monday accepted the tender of Messrs. Siemens Bros. & Co. for the supply of a steam-driven exciter set, at £917.

Dartford.—The U.D.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for pipe work in connection with the extension of the generating plant, at £383.

Fulham.—The B.C. has received the following tenders for extension of cables, feeders, &c.:—

Messrs. W. F. Dennis & Co.	£1,779
Johnson & Phillips	1,780
Electrical Co.	1,905
British Insulated and Helsby Cables, Ltd. (stoneware ducts) ..	2,000
Ditto (fibre ducts)	2,065
Western Electric Co.	2,044
Ditto, ditto	2,116
W. T. Henley's Telegraph Works Co. (fibre ducts) (accepted)	2,075
Ditto (stoneware casing)	2,012
Callender's Cable Construction Co.	2,104
W. T. Glover & Co..	2,132
St. Helens Cable Co..	2,209
Ditto	2,316
Siemens Bros. & Co. (fibre conduit)	2,362
Ditto (stoneware conduit)	2,295

The Council has placed an order with the British Thomson-Houston Co. for 25 penny-in-the-slot meters, at £103.

Hackney.—The B.C. has accepted the tender of Messrs. Le Grand & Sutcliff for the artesian well and air lift pumping plant, at £1,370 16s.

London.—The Metropolitan Asylums Board accepted on Saturday the following tenders for the annual supply of electrical accessories:—

Messrs. Pryke & Palmer, 31 items; General Electric Co., 14 items; Electrical Co., Ltd., four items; W. T. Henley's Telegraph Works Co., Ltd., four items; Edison and Swan United Electric Light Co., Ltd., three items; Frankenburg and Sons, three items; Goossens, Pope & Co., three items; McGeoch & Co., three items; Sunbeam Lamp Co., three items; Veritys, Ltd., three items; Armorduct Manufacturing Co., two items; Berliner Telephone Manufacturing Co., two items; Berry & Skinner, two items; British Insulated and Helsby Cables, two items; Johnson & Phillips, two items; London Electric Wire Co., Ltd., two items; Sun Electrical Co., two items; Tucker & Co., two items; Baxter & Caunter, one item; G. Braulik, one item; Brush Electrical Co., one item; Connolly Bros., Ltd., one item; Davis, Kent & Stewart, one item; H. Greene & Co., one item; Siemens Bros., one item.

It was explained that as these contracts were almost entirely for replacements and renewals, it was impossible to give any reliable estimate of their probable respective values.

Loughborough.—The Town Council received the following tenders for a 10-instrument and exchange installation:—

Messrs. Gent & Hurley (accepted)	£386 14 7
Messrs. Pullin & Shore	425 0 0
Messrs. W. J. Furse & Co.	426 16 9
The Electric and Ordnance Accessories Co., Ltd. ..	570 7 0

London.—The Highways Committee of the L.C.C. has received the following tenders for the supply of (1) low-tension switchboards for the Battersea and Wandsworth sub-stations, and (2) high and low tension switchgear for sub-stations at Battersea, Clapham, Streatham and Wandsworth:—

LOW TENSION SWITCHBOARDS.

Evered & Co. .. .. .. (recommended)	£1,347	10 0
Edison & Swan Co.	1,439	16 3
John Fowler & Co., Leeds	1,732	0 0
G. Statter & Co.	1,732	9 0
General Electric Co.	1,855	7 6
L. Robinson & Co..	1,982	18 0
J. E. Spagnoletti & Co.	2,008	10 0
Electric Construction Co.	2,053	10 0
Bertram Thomas, Manchester..	2,055	18 6
British Westinghouse Co.	2,101	1 0
Cecil Hodges & Co.	2,157	14 0
Consolidated Electrical Co.	2,226	0 0
Siemens Bros. & Co.	2,344	0 0
A. Reyrolle & Co.	2,382	9 6
Walsall Electrical Co.	2,564	4 6
British Thomson-Houston Co.	2,701	14 0
Kelvin & James White	2,853	9 6
Bailey, Grundy & Barrett	3,148	5 6

HIGH AND LOW TENSION SWITCHGEAR.

Edison & Swan Co.	£8,427	0 0
General Electric Co. .. .. (recommended)	10,129	12 0
Electric Construction Co.	10,317	10 0
Siemens Bros. & Co.	10,568	10 0
A. Reyrolle & Co.	11,421	19 0
Dick, Kerr & Co.	12,042	6 3
Kelvin & James White	12,336	6 0
British Westinghouse Co.	12,705	7 0
British Thomson-Houston Co.	13,178	6 0

The tender of the Edison & Swan Co. was withdrawn, owing to an increase in the prices of the proposed sub-contractors.

Southwark.—The B.C. has placed an order with Messrs. Pritchetts & Gold, Ltd., at £227 18s., for overhauling the battery at the generating station, renewing plates, &c.

West Ham.—The Corporation has received the following tenders:—Arc lamps for the lighting of Victoria Dock Road:—

Gilbert Arc Lamp Co.	£5 9 6 each.
Brockie-Pell Arc Lamp, Ltd.	4 18 6 each.
Crompton & Co. (accepted)	4 11 0 each.

Two potential regulators to be fitted to two of the feeders at the generating station:—

Cowans, Ltd.	£87 0 0 each.
British Electric Transformer Co., Ltd.	82 0 0 each.
British Westinghouse Co., Ltd. (accepted) ..	74 12 6 each.

The Corporation has placed the following orders:—

Dick's Asbestos Co., covering four boilers at generating station £19 12 6
S. Dixon & Co., Ltd., six additional sets of automatic tramway points.

Willesden.—The U.D.C. had before it on Tuesday the following alternative offers from the British Westinghouse Co.:—

(*a*) To supply one 250-kw. 25-period rotary converter complete with transformers, regulators, and accessories for the sum of £1,158.

(*b*) To exchange the existing 700-kw. 25-period plant consisting of two 100-kw. and two 250-kw. rotary converters, and provide plant suitable for operation on 50 periods with an increased capacity of 200 kw. by installing a 900-kw. plant, consisting of two 150 and two 300-kw. rotary converters for the sum of £800.

It was decided to accept the latter offer.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Thursday, August 3rd.—Recruits and non-efficients for Isle of Wight Camp, parade at Waterloo Station (L. and S.W.R.) at 12 noon. Those for Plymouth Camp, at Paddington Station (G.W.R.) at 10.20 a.m., and those for Gravesend Camp at London Bridge Station (S.E. & C.R.) at 11.20 a.m.

Saturday, August 5th.—Efficients for Isle of Wight Camp, parade at Waterloo Station (L. and S.W.R.) at 12 noon. Those for Plymouth Camp, at Paddington Station at 10.20 a.m., and those for Gravesend Camp, at London Bridge Station at 11.20 a.m.

J. Gunn, Sergeant-Major.
For O.C.E.E.R.E.(V.).

NOTES.

Institution Notes.—The Iron and Steel Institute.—The autumn meeting of the Institute is to be held at Sheffield on Tuesday, Wednesday, Thursday and Friday, September 26th to 29th. The following papers have been offered for reading:—

On the "Metallurgical Department of Sheffield University," by Prof. J. O. Arnold, Sheffield.
On the "Thermal Transformation of Carbon Steels," by Prof. J. O. Arnold and A. McWilliam, Sheffield.
On the "Nature of Troostite," by Dr. Carl Benedicks, Upsala.
On the "Occurrence of Copper, Cobalt and Nickel in American Pig-Irons," by Prof. E. D. Campbell, Ann Arbor, Michigan.
On "Pipe in Steel Ingots," by J. E. Fletcher, Sheffield.
On "Steel for Motor-Car Construction," by L. Guillet, Paris.
On the "Presence of Greenish-coloured Markings in the Fractured Surface of Test Pieces," by Captain H. G. Howorth, R.A., Sheffield.
On "Over-heated Steel," by Arthur W. Richards, Grangetown, and J. E. Stead, F.R.S., Member of Council.
On "Segregation in Steel Ingots," by B. Talbot, Middlesbrough.
On a "Manipulator for Steel Bars," by Douglas Upton, Jarrow.
On "Machinery for Breaking Pig-Iron," by Cecil Walton, Whitehaven.
On the "Influence of Carbon on Nickel and Iron," by George B. Waterhouse, New York.

A lengthy programme of works' visits and excursions has been issued by the secretary, Mr. Bennett H. Brough, 28, Victoria Street, S.W.

Electric Shock Fatality.—On 20th inst., at Willesden, an inquest was held concerning the death of John O'Malley, 25, an electrician, who, as mentioned last week, was killed at the British Westinghouse electrical power station at Neasden. In the course of the evidence, it was stated by a man who worked with deceased that O'Malley had no right to go into the transformer chamber where the accident occurred. Deceased was a sober, steady man, and was not likely to commit suicide. It was generally known that the transformer chamber was a very dangerous place, and no one ever went into it while the current was on. Another witness said that when he found the deceased his clothes were alight; he must have received an 11,000-volt shock. The door of the transformer chamber was not locked, but men were instructed not to enter it. The jury returned a verdict of "Accidental death," adding a rider that the door should be locked and labelled "Dangerous."

Exhibitions.—The following letter from the Power-Saving Pulley Co., of Manchester, appeared in Wednesday's issue of *Electrical Investments*:—"With regard to the subject of exhibitions, we think that they are generally more successful at first appearances—repeated shows get weaker every time. Bands are a nuisance, and only serve to distract both buyer and seller. Inviting municipal bodies and committees to hold conferences and confer together, instead of conducting them to the exhibits, is for many reasons irritating to the exhibitor. We have gone to considerable expense at several trade shows, but we now feel that the same outlay in reputable publications will have at least an equal, if not much better practical business result."

Electric Motor Ambulances.—At the London County Council meeting on Tuesday, the General Purposes Committee again brought forward the proposal to establish a service of motor ambulances worked by electricity. In the opinion of the Finance Committee the scheme should, on financial grounds, be postponed until the estimated recoupments from the Holborn-Strand improvement have been substantially realised, and until the financial position of the steamboat service has been ascertained. The Council, however, decided to apply to Parliament for the powers suggested by the General Purposes Committee.

Gas Accidents.—At Lichfield last Saturday morning, Lieut.-Col. O. B. Feilden was suffocated by a gas jet being accidentally and unconsciously turned on before he retired to rest. Mrs. Feilden had a narrow escape, being in a critical condition when discovered.

On 25th inst. a serious accident occurred at the Ashton-under-Lyne Gasworks, a son of the manager who was engaged in the testing room at the time being badly injured. The building was completely wrecked.

Appointments Vacant.—A telegraph officer for Southern Nigeria; chief clerk, correspondence clerk and working depôt foreman for Erith U.D.C. tramways department; junior assistant engineer for Leek (25s.); junior assistant electrical engineer for Burnley (£119 12s.).

Educational Notes.—The report of the first year's working of the Leeds University forms an interesting record of progress. The number of students attending the day classes has increased to 842, as against 807 previously attending the Yorkshire College, and there was also an increase of 52 students attending the evening and other classes. The provision of additional accommodation in the department of Electrical Engineering is urgently needed, as it possesses no lecture-room of its own and no drawing office, while the laboratories are totally inadequate to meet the demands upon their space. Additional plant is wanted, especially two D.C. motors of 24 and 10 H.P. respectively, as well as other expensive apparatus. In the United States such apparatus would be presented to the University by the great manufacturing firms; here, on the contrary, we only read of one donation of this kind—a double-pole enclosed switch and fuse, by a Leeds firm, Messrs. Franklin & Isaacson. Having in view the national importance of technical training, and the high reputation won by the Yorkshire College, we could wish that British manufacturers would more freely give their support to institutions such as the Leeds University, with which the college is now incorporated.

The June issue of *The Central* (Central Technical College Old Students' Association) contains, amongst other interesting articles, one by Mr. A. T. Larter, on "Suction Gas Producers," in which the principles of working and the mode of operation of these useful gas generators are discussed, with special reference to the Dowson type. The article is well illustrated, and there are a number of indicator diagrams from various engines working with the Dowson suction plant. The number is well up to the high standard which has characterised the previous issues of this journal.

The Council of the City and Guilds of London Institute has awarded the diploma of Associate of the Institute to 23 students of the Central Technical College who have passed through the full course of instruction in electrical engineering, 22 in civil and mechanical engineering and three in chemistry. The Siemens medal and premium in electrical engineering have been awarded to W. H. Grinsted. In addition, certificates have been awarded to 32 matriculated third-year students who have completed a full course of instruction at the Central Technical College, and to 68 who have completed full courses at the Technical College, Finsbury.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—The Electric Lighting Committee reported to the Bermondsey Borough Council that Mr. Heenan, the newly-appointed borough electrical engineer, took up his duties on Friday, June 30th. The Committee expressed their high appreciation of the manner in which Mr. Doran, the chief assistant electrical engineer, had superintended the undertaking between the departure of the former chief engineer and the arrival of his successor. Although Mr. Doran was only appointed in November last, at £145 per annum, the Committee thought it was most important to retain so capable an officer, and recommended that his salary be increased to £200 per annum. In consequence of a standing order of the Council that applications for increase can only be considered in February of each year, the recommendation was ruled out of order, but on all sides much appreciation was expressed of Mr. Doran's work. A switchboard attendant having resigned, it was resolved that he be replaced by a third engineer-in-charge, at 40s. per week.

Nelson T.C. has appointed Messrs. W. Hartley, J. R. C. Murray, and M. E. Dent as assistants at the electricity works, at £1 each per week.

The second section of the Hastings Corporation electricity employés held their outing to Tenterden on Wednesday last week. The company included the borough electrical engineer (Mr. R. F. Ferguson). Tenterden was reached at dinner-time, when some of the party made a tour of the town, whilst others enjoyed a game of bowls. The Tenterden Flower Show was also inspected. Tea was taken at Northiam, where a vote of thanks was passed to Mr. Ferguson. The first half of the employés had their outing on the Wednesday previous.

Mr. Nixon has been appointed chief electrical engineer to the Handsworth U.D.C. at £350. There were 90 applicants.

The Bray Council has appointed Mr. D. E. M'Donnell, of Macroom, to be assistant electrical engineer.

The salary of Mr. R. S. Downe, the electrical engineer to the Southport Corporation, is recommended for an advance from £500 to a maximum of £600, rising to this sum by annual increments of £50.

Southend-on-Sea T.C. has appointed Mr. H. K. Rowe as switchboard attendant at the electricity works; and Mr. A. C. Johnson, of Burnley, as assistant engineer at a salary of £150 per annum.

Tramway Officials.—The employés of the Southport Corporation Tramways had their annual sports on the 19th and 20th inst., at Kew Gardens. Alderman Hulme, chairman of the Tramways Committee, presided over the proceedings on the first day, and Mr. J. Sykes on the second. Numerous events were contested, and prizes, contributed by local and outside

donors, were presented. An athletic society was formed some time ago, the members paying 1d. per week.

Brighton Corporation Tramways Committee on 20th inst. unanimously appointed Mr. WM. MARSH as tramway engineer and manager at an annual salary of £300, rising by £50 a year to £400. Mr. Marsh has been acting engineer and manager for the last two months.

Mr. SCOTT has resigned his position as tramway overhead foreman at Southend-on-Sea.

Halifax T.C. has received 103 applications for the position of tramway traffic superintendent.

General.—The marriage of Mr. HAROLD W. DAVEY, electrical engineer to the Eastern Telegraph Co., at Durban, and Miss Constance Piccione, of Mooi River, took place recently in the Emmanuel Cathedral, Durban. After the ceremony a reception was held at Erin Lodge, the residence of the bride's mother.

Mr. MARSHALL H. BENNETT, A.M.I.M.E., A.M.I.E.E., has resigned his position with the General Electric Co., Ltd., of London and Witton, and is joining the British Thomson-Houston Co., Ltd., of Rugby.

The Durban Special Committee appointed for the purpose of suitably recognising the extraordinary labours of those employed in repairing the havoc made by the recent great storm, submitted a report recommending that grants be made to, among others, the assistant borough electrical engineer, Mr. A. G. H. TAYLOR, and Messrs. E. POOLE, C. W. BROKENSHA and J. T. SMITH, of the electrical department.

The election is announced of Mr. DUGALD CLERK, M.I.C.E., the well-known gas engine expert, as president of the Junior Institution of Engineers for the ensuing session.

LORD STANLEY, M.P., will to-day, in the refreshment club of the General Post Office North, present to Mr. J. C. BADCOCK a testimonial subscribed for by his colleagues upon his retirement from the position of Controller of the London Postal Service.

Mr. J. COXON was appointed by the West Ham Corporation on Tuesday, instructor in electric wiring at the Technical Institute.

Mr. ALLAN R. CONNAL, who has been with the National Electric Construction Co., Ltd., for some years, has just resigned his position as engineer and district manager of their Midland branch in Wolverhampton, in order to take up the management of the Manchester business of the Alliance Electrical Co., Ltd., and his address after the end of this month will be Northern Assurance Buildings, Albert Square, Manchester. We understand that he will make a speciality of electric pumping, haulage and driving generally for collieries, chemical works, breweries, and cotton mills.

CITY NOTES.

General Electric Co.

MR. G. BYNG presided at the annual meeting of this company, held at the offices in Queen Victoria Street, E.C., on Monday last. In moving the adoption of the report (see ELECTRICAL REVIEW, July 21st, p. 108), he said that to him the year had been one of distinct disappointment. They had done rather more business than in the previous year, but the effects of competition had been reduced profits, which symptoms had been felt by almost every manufacturer in this country who had had to report decreasing business, and either decreasing dividends, or had to take from reserve to make up what they made last year. This was not a very satisfactory state of affairs, but in this company they had still been able to depreciate £17,920, which was about £300 more than last year. It was an important thing for a company like theirs to look after proper depreciation, because no manufacturer could consider that he had made any money if he had not thoroughly depreciated his plant in his books. They had been able to put sufficient into reserve to fulfil the hope expressed last year, that they should have in their reserve cover sufficient for the item of goodwill and patents standing in the balance-sheet at £92,000. The policy of the directors had always been to strengthen the financial soundness of the business, and that policy had again been carried out by reducing the interest on ordinary shares rather than seriously diminishing the amount placed to reserve. The income from investments to a slight extent counteracted the decrease of profits from trading account. There was £16,000 more invested, which was principally due to the natural increase of the Uxbridge Co., in which they were largely interested, and the formation of the General Electric de France. They had acquired the business of their former agent, Mr. Lucien Espir, at Paris, and turned it into a limited company under the above name; Mr. Espir was a considerable shareholder. The concern was an important one to them, as Paris was very near, and they not only sold in France, but were also buyers of many electrical articles therefrom. Selling in France would be very considerably increased if the duties were not so very high. Many of the articles that this company made were produced far superior in quality than anything to be found in France. He had been last winter at Cannes, and the manager of the hotel there expressed a wish to have everything electrical brought in from England, but the duties were so high that with many of the articles it was impossible. If one day they could induce the French to reduce those duties in their favour, it would be an enormous pull to such a concern as this. The other figures were fairly similar to the balance-sheet of last year. Sundry creditors were £30,000 more, which was principally due to the Dublin contract, and sundry debtors and stock-in-trade had only increased in proportion to the increased turnover. As regards the general features of the year's trading and manufacture, the new department at Witton had gone ahead extremely well; and those works had shown a very fair profit on work completed. The Underground order for 340 motors mentioned in last year's report had, however, only recently been put into the shop, the details of construction, and supply and delivery having only just lately been settled, and it had therefore not contributed to this year's results. An important contract had been obtained for the supply and erection of motors for electrifying all the workshops of the Portsmouth Dockyards—the receipt of this Government contract had been very gratifying to them from every point of view. They had received a fair amount of orders for large machines, such as contracts for Cardiff, South London, Woolwich, Fulham, Manchester and Dublin. As regards the last-mentioned, the new 1,500-KW. set supplied during last year had turned out a great success, whilst the old contract had at last been satisfactorily completed. It would be remembered that they supplied with their generators, through sub-contractors, engines which did not pass the necessary tests, and the company as main contractors were compelled to undertake the re-construction of these engines. He was pleased to say that they had on all points come well within the specification, as the chairman of the Dublin Electric Light Committee, the resident engineer, the consulting engineer, and the Lord Mayor of Dublin recently stated at a public banquet, and the plant had been taken over. This was a contract from between £50,000 and £60,000, and he believed, thanks to the great effort of Mr. Hirst and the staff at Witton, that what once threatened to become a serious failure had turned out a complete success. As regards their other manufactures, such as telephones and bells, electric light fixtures and accessories, they had to report increasing output, but generally with lower prices and more difficulty to sell. The question of difficulty in selling was one that was engaging the serious attention of the directors. People outside the trade had no idea how much more difficult it had become to obtain orders anywhere. What he called the commercial push—the looking after orders, advertising, cost of travellers, and the lowering of prices—was a very serious item, which it never had been before. It was, he believed, largely due to the enormous competition which they had to meet here in this country from all over the world. It was sheer waste. They had to spend a lot of money, and the consumers gained nothing by it. In America and Germany that waste had been done away with through combinations and trusts. These had a very bad name, but when they looked at it from the point of view of avoiding losses in manufacturing and losses in trying to get orders, it was a sheer waste to the whole community, and they would find that the question of combinations and trusts should be considered from some point of view different from that which it had been often viewed from by many people. They found that the cost of commercial push was quite excessive at the present moment. Such conditions had thrown upon their staff vastly more work, and they had had to appeal to their loyalty, an appeal which had been met with that self-sacrifice which they expected from them. The carbon works had, during the last 12 months, arrived in one respect at a most satisfactory stage. Under their own management, with self-trained labour, they were now producing a quality which was second to none, and if the prices obtained were anything similar to those ruling at the time of the starting of the works, they could conscientiously call these carbon works a great success. These prices had, however, in consequence of unrestrained competition in this country, dropped again. They had it on the authority of two leading manufacturers on the Continent that they were selling in this country at an absolute loss. Partly through a protective tariff, and partly through other legislation, their market in their own country was secured, and, therefore, while obtaining a better price at home, they could afford to sell at a loss in this country until such time as this company might be compelled to close down. By support obtained from Government departments and other public institutions, they had succeeded in considerably reducing the loss of last year, and it was their firm intention to keep this factory going until such time that by suitable Government measures they could hope to put it on a dividend-paying footing, a time which they hoped would not be far distant. They could not promise to keep it on for ever. They hoped the Government would say that this was an industry which must be supported by Government help. Considering that the manufacture of carbons was an industry which was not only a commodity of consumption, but a most essential article required for modern defence of our coasts, our harbours, our ships, &c., they thought they were entitled to expect within a reasonable period some measure of support. To a big manufacturing firm like this company, the question of protection of the Home Market was of vital importance. It was of as much importance to them as the obtaining of their daily orders. He had previously told them why he was certain such protection must come, and he would not then repeat arguments which were sufficiently patent, but only refer to two matters which, during the last years, had become acute, and which, to his mind, were the direct outcome of our mistaken Fiscal policy. He referred to the question of rates and taxes and the unemployed. The burden of rates and taxes upon English industries was becoming a serious and a dangerous one. This firm paid directly or indirectly in rates and taxes a sum per annum exceeding £15,000, which represented 5 per cent on their ordinary share capital, and they were threatened with more imposts. In a leading journal it was recently stated that the only alternative to tariff reform was more socialistic taxation. It was a very serious matter to such firms as theirs which had enormous factories all over the country to be in the position of being taxed up to the hilt and always threatened with more. This already serious situation became immeasurably more so when they considered that foreign manufacturers also sold similar articles in competition in their markets, and that these foreign manufacturers bore no part in this enormous taxation. If they were not taxed in this way, the company could have paid 10 per cent, instead of

5 per cent. As for the unemployed, he wished to say that he considered the present state of employment and pauperism the direct outcome of our Free Trade policy. He said so as a large employer of labour. The G.E. Co. could undertake, if Protection were given their firm, to employ within six months, at least 2,000 skilled workmen more than they did that day, and he knew hundreds of manufacturers who could give a similar undertaking. Only the other day, 20 manufacturers met together, and he said then that he could employ 2,000 more, a large steel manufacturer said he could employ an additional 500 people, a cable manufacturer said 300 more, and between them these 20 manufacturers made sufficient promises that between 8,000 or 10,000 more workmen could be employed, or guaranteed to be employed, if they had an alteration of the Fiscal policy of the country. Surely it was common sense to believe that more employment would be given to British workmen if these articles which they could make, were made in this country, and not imported from abroad. They would soon have a change of Government. It was his firm conviction that no Government could leave those two acute social situations where they were at present; and that when they came face to face with the realities of practical politics, they would find that the only solution—and a simple solution—would be to secure the Home Market to the home population. It would be a happy day for this firm when once this justice was done to the English manufacturer. He then formally moved the adoption of the report.

Mr. M. BYNG seconded the motion.

Mr. FRED. WALKER congratulated the chairman that "even under present circumstances," he regarded the protection outlook with such magnificent optimism. He was glad that the company, in spite of the fierce competition, had not sacrificed quality. That was the basis of the strength of the company. The tremendous competition had argely arisen from the fact that the electrical industry had come to us greatly from very active and hasty, and sometimes rash and energetic people, like the Americans. The impression got abroad that the demand for electrical apparatus, machinery and devices would be so colossal and so enormous that it would be absolutely impossible to cater for it, and consequently the Westinghouse and others came here. The English people were very much slower—perhaps they were wise—perhaps otherwise—but the idea that every Tom, Dick and Harry was going to pull out his existing gas engines, water wheels and steam engines, and put in everything electrical, had not been carried out. We were going slower, and had got to put up with it. But the change would come, though slowly, all the more certainly. He was vice-chairman of a slate quarrying industry in Wales, and they had re-established the whole quarry on an electrical footing. They were absolutely surprised to think how they could have gone on for the last 20 years with the inefficient system they had before, now that they got everything so much smoother, better and more satisfactory. Wales was most conservative, but they found that big people were coming down to see their installation. The electrical industry had a splendid future in Wales.

Resolutions approving of the 5 per cent. dividend, re-electing Mr. Bevis a director, re-electing auditors and thanking the directors, were passed unanimously.

National Telephone Co.

SIR HENRY FOWLER, M.P., presided over the thirty-sixth ordinary meeting of this company, held at Hamilton House, on Thursday of last week.

The CHAIRMAN, in moving the adoption of the report (ELECTRICAL REVIEW, July 14th, p. 69), said that he had a very simple duty to discharge that day. As they were aware, that meeting was an interim one, and at their annual meeting they more completely and accurately reviewed their commercial and financial position, but that was held more at the end of the year. The half-year had been a satisfactory one to the directors, and he hoped to the shareholders. The income during the half-year amounted to £1,086,507, and the figure for the corresponding period in 1904 amounted to £985,274, an increase of £101,233 in the gross income of the company. The first deduction that they had to make was the Post Office royalty, which was £90,742 for the first six months of 1904, this year it had increased by another £10,000. When the public were told what very high charges were made by the company for telephone rates in London and the provinces, they should be asked to deduct 10 per cent. from that charge, the balance representing what the company received. The working expenses during the six months were £630,251, as against £563,060 12 months ago, showing an increase of £67,191. If they increased their business, they must increase their working expenses. The result which they were most interested in was the profit for the half-year, which was £355,618, as against £331,472 a net increase of £24,146. They brought forward from the last six months £10,141; 12 months ago they brought forward £10,505, which showed a decrease of £364. They proposed to pay a dividend the same as last year, the available sum being £365,759. Their debenture and other interests amounted to £97,143. They proposed to carry £110,000 to reserve, which was £10,000 more than they carried to the reserve 12 months ago. He thought the shareholders would see the wisdom of that course when they considered the very large expenditure made during the year, and the large additional capital that had to be protected by the reserve fund. They proposed, if the shareholders agreed, to carry forward £9,699. Their capital expenditure, he was glad to say, had been increased. They had spent on construction of exchange and private stations and other works £477,156 during the half-year. They had spent on lands and buildings £60,000, which brought the total up to £534,320. The ordinary expenses, as he had previously mentioned, had steadily increased. Their rents, taxes and insurance had increased, and the maintenance of the Post Office underground wires last year cost upwards of £17,000. In their balance-sheet their stock of materials had been reduced. They were all aware that there had been a Committee to whom the House of Commons had referred the question of approval or disapproval of the agreement which they had entered into with the Government last February. The inquiry had been closed, and the Committee had adjourned to consider their report. He thought it would be very unwise to have any discussion that day upon that agreement, or upon the effect it would have upon the company's course, and as to the course which the directors should pursue with reference to it. Of course when the committee had given their decision they would then be prepared to go fully into the matter. The number of shareholders six months ago was 10,463; that day it was 10,461. The average holding was £525 per shareholder. The debenture stockholders were about 20 more, the average holding being £821. Their staff had increased; last year it was 12,902, this year it was 14,647, and, of course, there had been an increase in wages. Their unexecuted orders 12 months ago numbered 12,902, that day they were 10,842. He drew from that that their business was rapidly outstripping their available capital. The number of messages in 1904 carried on their system was 995,671,664.

Mr. GEORGE FRANKLIN seconded the motion, and it was carried.

The CHAIRMAN proposed the re-election of the retiring members of the board, Mr. C. S. Agnew, the Right Hon. Lord Harris, Mr. G. Hunter Robertson, and Sir A. K. Rollit, M.P.

Mr. STRICKLAND seconded the motion, and it was carried unanimously.

Mr. LEA SMITH proposed a vote of thanks to the chairman, directors and staff, and Mr. J. GILLOSON seconded the resolution, and it was carried.

The CHAIRMAN having briefly replied, the proceedings terminated.

The British Electric Traction Co.

THE meeting of this company was held at Winchester House on Monday last, Sir Charles Rivers Wilson presiding.

In moving the adoption of the report (ELECTRICAL REVIEW, July 21st, p. 109), the CHAIRMAN said that it presented no new feature this year. The general depression had very greatly affected tramways, and, in fact, he had found that tramways were the first to feel the effects of bad trade. The depression was not characteristic of any particular place, but was felt all over the country. The company had endeavoured to economise in various directions, and had determined to limit its further commitments in the way of new schemes; but they would not suspend all enterprise. The exercise of the veto by the local authorities had greatly checked tramway enterprise in this country, and there could be little doubt that in many cases it had been improperly used. Unless things altered in that direction, it would be a matter for serious consideration by the board whether any further extensions should be made. Dealing with the various undertakings belonging to the company, the chairman said that the Pontypridd undertaking had been sold complete, and the Barrow line was being reconstructed for electric traction. A company called the Bombay Electric Supply and Tramways Co., Ltd., had been formed to take over the lighting and tramways business in Bombay. The old horse tramways in Bombay had been perhaps the most successful tramways system in the world, and it was anticipated that when the whole of the lines were reconstructed for electric traction, the tramways would be even more successful. Bombay had a population of over a million people. The company would require a large amount of capital, and provision had been made for issuing £600,000 debentures and £600,000 preference stock. The Brush Co. had already received large orders for plant. At Birmingham the company had come to an arrangement which would prevent the great inconvenience to the public which would arise from the municipality taking over the whole of the lines in Birmingham. The company had also amalgamated with the Motor-Omnibus Co. in Birmingham, and they had erected works at Loughborough where they could turn out motor-omnibuses. Their investment in the Metropolitan Electric Tramways Co. was making satisfactory progress, not merely in the development of the important tramway and light railway enterprise in the northern suburbs of London, but also in connection with the electric power supply business. The question of electric power for London had recently been very much to the front, and he thought it would be a matter of interest to the shareholders to know that the company owned a Power Act covering over 300 sq. miles, in Middlesex, Hertfordshire and Essex; and the district in question would probably, in the near future, show a very considerable development for industrial purposes. Coming to the general question of competition by motor-omnibuses, the chairman said that he did not think they had anything to fear from those vehicles. Well-designed electric tramways need have no fear of this competition at all. No doubt petrol omnibuses had a special field of usefulness, but it lay in directions other than those in which electric tramways had proved successful, and it would be merely waste of energy and capital to attempt to run motor-buses in competition with an electric tramway.

Mr. EMILE GARCKE seconded the motion.

A Mr. CHARTIER, a shareholder, raised several objections to the report, which he declared was far too long and involved. The sum proposed to be divided as dividend was excessive to the extent of £23,152, for, he alleged, only £14,000 was rightly so divisible. He moved that the report in its present form be not adopted.

No one came forward as a seconder, and the motion dropped.

Mr. CROFT, a shareholder, said that, as a resident in the neighbourhood of Brighton, he would like to know what the directors

intended to do with regard to the Brighton and Shoreham Tramway. Were they going to electrify the line? He thought that if they were going to do so it should be done at once, for the tramway was of very little service as now carried on.

The Chairman, in reply, said that he quite agreed with Mr. Croft, and the matter would receive the board's earliest attention. The company had obtained powers to extend the line to Worthing, and the whole matter would shortly be gone into.

The report was then adopted.

Sir C. Rivers Wilson was re-elected a director.

City and South London Railway Co.

For the half-year ending June 30th the directors report that the receipts from all sources for the half-year amounted to £76,164 and the cost of working has been £35,134, leaving a profit of £41,030. Inclusive of the balance brought forward from December 31st last, the net revenue account shows an aggregate total of £42,925. After making provision for the debenture stock interest, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £30,200. Out of this sum the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896 and 1901, and that a dividend at the rate of 2 per cent. per annum be paid up on the consolidated ordinary stock for the half-year, leaving a balance of £1,042 to be carried forward. The following table shows the number of passengers, exclusive of season ticket holders, carried, and dividends paid during the last few years:—

Half-year.	Number of passengers (exclusive of season ticket holders).	Receipts (including season tickets.	Dividend per cent. per annum on ordinary stock.
		£ s. d.	
Ended December 31st, 1902 ..	9,877,199	82,131 7 1	3½
,, June 30th, 1903	9,511,450	78,384 19 9	2¾
,, December 31st, 1903 ..	8,711,062	72,286 3 6	2
,, June 89th, 1904	9,226,987	76,387 14 1	2¾
,, December 31st, 1904 ..	8,401,846	70,705 10 11	1¾
,, June 30th, 1905	8,662,588	71,802 7 8	2
The totals since the opening of the line in 1890 are:	143,871,702	£1,147,419 0 8	

The continued competition of the London County Council electric tramways, coupled with the abnormally dry weather that prevailed during the greater part of the half-year, has adversely affected the traffic. To meet the very low fares charged by the tramways, the directors determined in May last to make a considerable reduction in the fares charged on the railway. An increase has taken place in the number travelling, but not sufficient so far to do more than compensate for the reduction made. A contract for the construction of the extension to Euston was let in March last, and the properties required for the stations have all been acquired, the shafts for the lifts are down to their full depth, and the tunnels have been commenced. It is hoped that the line will be opened for traffic before the end of next year. The £150,000 of ordinary stock was disposed of in February last, and has provided all the capital required at present.

Central London Railway Co.

The report for the half-year ended June 30th last states that the amount expended on capital account during the half-year has been £11,232. The receipts from all sources of revenue amount to £185,876, being an increase of £914, and the working expenses to £95,674, an increase of £548 compared with the corresponding period of last year, leaving a balance of £90,201 to be carried to the net revenue account. The total number of passengers carried during last half-year shows an increase of 68,038, and the number to whom cheap return tickets were issued, workmen and others, was 3,051,196, a decrease of 30,174, or ·98 per cent., as compared with the corresponding period. The average receipt per passenger is 1·86d., the same as in the half-year ended June, 1904. After providing for interest on debenture stock and other payments, the net revenue account shows a balance of £94,886, including £22,111 brought forward. The directors recommend the declaration of the following dividends:—On the undivided ordinary stock at the rate of 4 per cent. per annum; on the preferred ordinary stock at the rate of 4 per cent. per annum. After reserving £10,606, the proportion of dividend applicable to the deferred stock, which is not payable until the result of the year's working has been ascertained, there remains a balance of £34,886 to be carried forward. The company's Bill in Parliament for an extension of the line to Hammersmith and the City reached the stage of second reading in the House of Commons, when its further progress was stopped and second reading postponed by the authorities, pending the publication of the report of the Royal Commission on London Traffic. Having regard to the shortness of the time remaining, it is now impossible for the Bill to be proceeded with this session. The report of the Royal Commission has just been issued to the public, but the board has not yet had an opportunity of considering it. The Great Western Co.'s Bill, which included provision for a new suburban station adjoining the Shepherd's Bush station of the Central London Railway Co., has passed through both Houses of Parliament, and received the Royal assent on 11th inst. As explained in the report for the half-year ended December 31st last, this means of exchange with the Great Western Railway should be of great advantage to the travelling public and to the companies concerned.

Dublin United Tramways Co.

The report for the half-year ended June 30th states that the amount available for division is £45,355, out of which it is recommended that a dividend be paid for the half-year at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares, and that a sum of £5,000 be added to the reserve fund. The dividends recommended and the sum added to reserve will absorb £40,100, leaving £5,255 to be carried to next account. Extensions of the tramways from Rathmines to Dartry Road and from Dolphin's Barn to Rialto Bridge, South Circular Road, were opened for traffic during the half-year.

At the half-yearly meeting held in Dublin on 25th inst. Mr. W. M. Murphy said that the revenue account did not differ materially from that of the corresponding half-year of 1904, and whatever difference existed was a favourable one. The gross receipts had increased by £2,421, and the expenditure by £1,204, leaving an additional profit of £1,217. The whole of the addition to the revenue was derived from passenger traffic, the other items being practically the same as last year. They carried 24,610,000 passengers during the half-year, of whom more than twenty millions represented penny fares. They carried altogether 332,000 more passengers than in the corresponding period of 1904. They had effected still further economies in the cost of generating electric current. Though they generated 300,000 units, or about 8 per cent. more than in 1904, the total cost of operation was £155 less. The net result of the half-year's working was, receipts, £130,909; expenditure, £72,377, and profit, £58,532.

Direct United States Cable Co.

Mr. E. M. Underdown, K.C., presiding at the meeting held at Winchester House on Tuesday, said that the report was a very favourable one. After referring to the figures as stated in the report in our issue of July 21st, p. 111, he said that the improvement which was shown in the revenue during the last few months of 1904, to which he called attention at the last general meeting, had continued, and they had in the period under review an increase of £6,348, as compared with the corresponding six months of last year. That indicated a revival of business, and that communications between this country and the United States had not only resumed their normal figure, but there was considerable activity in business going on, and showing an increase. Not only had that increase been shown during the period under review, but since July 1st a continuing increase of something like 10 per cent. was shown over the corresponding month of 1904. The larger amount of business carried on involved a slight increase in the expenditure. They had had two repairs to shorter sections, but they had been able to add £6,000 to the reserve fund, which now stood nominally at £482,947, the market value of the securities being slightly in excess of that. For the whole year the revenue receipts had been £100,499, less expenses £44,680, leaving £55,819. They had paid in dividends £39,461, and had placed £16,000 to reserve, and had an increased balance in hand of £358. It was very satisfactory to be able to resume the payment of the addition to the dividend in the shape of the bonus. The diminution had been entirely owing to the stagnation of business, which lasted some time. The whole of the company's system continued to be in perfectly good working order. The staff had served them very well.

Sir J. Pender seconded the motion, which was carried unanimously.

The retiring directors and auditors were re-elected, and the board and staff thanked.

Nernst Electric Light, Ltd.

An extraordinary general meeting was held at Westminster Palace Hotel, S.W., on Monday, 24th inst., when the following resolutions were submitted for adoption:—

1. That the provisional agreement or offer of purchase negotiated in Berlin on July 11th, 1905, with the Allgemeine Elektricitäts-Gesellschaft and countersigned by the chairman of Nernst Electric Light, Ltd., under which it is proposed that this company shall sell and the Allgemeine Elektricitäts-Gesellschaft shall purchase and acquire all the patent rights possessed by this company for manufacturing and selling Nernst lamps elsewhere than in Europe and the United States of America and Canada and including this company's rights to the royalties payable by the Allgemeine Elektricitäts-Gesellschaft on deliveries of patented Nernst lamps for Great Britain for the sum of £24,000 to be paid in cash by the Allgemeine Elektricitäts-Gesellschaft, it being one of the terms of the arrangements that the existing agreement with the Allgemeine Elektricitäts-Gesellschaft for supply of Nernst lamps be cancelled and that the Nernst Electric Light, Ltd., renounces all claims to take proceedings in Germany against the Allgemeine Elektricitäts-Gesellschaft be, and the same is hereby confirmed, and that the directors of this company are directed to take all such steps as may be requisite for carrying the said arrangement into effect.
2. That out of the consideration (£24,000) to be paid by the Allgemeine Elektricitäts-Gesellschaft there be retained and distributed among the directors and staff of the company a sum of £3,000 as compensation for loss of office, and that such sum be divided in such manner as the board of directors of the company may determine.
3. That Nernst Electric Light, Ltd., be wound up voluntarily.
4. That Mr. M. Levinger, the manager and secretary of the company be, and is hereby appointed, liquidator of the company at a remuneration of £300.

The directors, in a circular to the shareholders laying this scheme before the shareholders, pointed out that "the existing agreement with the Allgemeine Elektricitäts-Gesellschaft for the manufacture of lamps will expire in the early part of 1907, and information has

been received from the Allgemeine Elektricitäts-Gesellschaft that they are not disposed to renew it. The question, therefore, before the shareholders practically resolves itself into the adoption of one of two alternatives—either to sell the rights at the price offered, which the directors are satisfied is the highest obtainable from the Allgemeine Elektricitäts-Gesellschaft, or to make arrangements abroad for the manufacturing of the company's requirements. Although the above offer may appear to the shareholders somewhat inadequate, the directors feel that, in view of the difficulties of the situation both as regards manufacture and the ultimate value of the invention, it should receive the serious consideration of the shareholders. In the event of acceptance, the directors would be enabled shortly to distribute a sum equivalent to 9s. a share, a final payment of approximately 1s. being made later, the amount of which would depend on the results of the liquidation of the company's assets, after providing for compensation for loss of office to the directors and staff."

Thomas Parker, Ltd.

The annual general meeting was held on Monday at the works, Wolverhampton, Alderman C. T. Mander presiding.

The Chairman, in moving the adoption of the report (which appeared in last week's Electrical Review), said he very much regretted that the accounts the directors had to submit were of such a disappointing character. The hopes they had a year ago that trade might revive somewhat and give them a chance by rigid economy and hard work to start on the upward track again, had not been fulfilled. He could refer again to considerable improvements and economies in design, but their sole cause of complaint this year was lack of orders. This reduction in orders was not the result of any want of efficiency in the works staff, but seemed to be universal in the electrical trade in England at the present time, and was brought about by the general bad trade of the country, combined with the large amount of capital which had been sunk in the industry during the last few years, and large new works which had been built, leading to extensions in the old works to meet the competition. For instance, in 1896, the total capital invested in electrical works in England was about two millions sterling, whereas at the present time it was nearly 12 millions, and it had doubled even since 1900. They could, of course, again show large reductions on the standing and general charges, but this was not so satisfying when it was the result of a slack shop as well as improvements in management, and with works of that size he did not think standing charges could be cut down any further without damage to the efficiency of the place. The electrical designs were still going through a course of rapid improvement, but he thought they had passed through the greatest difficulties in the trade, and in a short time they ought all to be able to take advantage of the struggle they were now passing through, which at the present time were entirely to the advantage of the consumer. The manufacturer would have to wait a little longer for his turn. As the report informed them, during the past year they reduced their hands and went on short time, but he was glad to say that a month or two ago they were able to go to full time, and they hoped the better state of things would continue, so as to enable them to show a better result next year than at the present time.

Mr. Armistead seconded the adoption of the report, and it was carried.

Messrs. Armistead and Rees were re-elected directors, and Mr. W. A. Nelson was reappointed accountant.

Mr. J. S. Collinge moved that the directors should make an interim report every six months. He suggested that the shareholders ought to know what was going on, and contended that a balance-sheet ought to be prepared every half-year. He, however, eventually withdrew this demand, and moved the resolution as stated.

Mr. Lewis seconded, and it was agreed to.

Crompton & Co.

The report for the year ended March 31st last states that although the volume of business done by the company is as large as in previous years, prices still rule very low. The results of the contracts carried out during the year have proved satisfactory, but the profits realised in this direction have been adversely affected by the low prices obtained for goods manufactured at the works. With a view to greater economy in the future, the directors have entirely reorganised the staff at Chelmford. The net profits for the year amount to £9,128, which compares with £14,584 in the preceding year. After providing debenture interest and other items shown in the net revenue account, there remains, with the sum brought forward a balance of £2,713. Considering that in prosperous years, instead of distributing large dividends, the directors placed substantial sums to a reserve fund, they are of opinion that the present occasion is one which justifies the application of part of such undivided profits to assist in paying a dividend; they therefore propose to take £4,000 from the reserve fund, to pay a dividend at the rate of 2½ per cent. per annum for the year, and to carry forward a balance of £656. The loans and other advances owing to the company by the Chelmsford Electric Lighting Co. have been repaid by the Electric Supply Corporation partly by debentures, and the costs of realising the debentures, as well as a small discount on the shares held in the new company, have been charged to the contingency fund. The balance of the contingency fund, £2,058, has been added to the provision for doubtful debts. Important contracts for constructing and equipping electric lighting and tramway undertakings, both in the United Kingdom and abroad, have been secured on terms which should undoubtedly result in satisfactory profits for the current year, so that the prospects of the company for the future are more encouraging. Amongst others, large contracts have been secured from the Electric Supply Corporation, and in order to assist in obtaining capital for that company it has been considered advisable to guarantee its earnings for four years, and for this purpose an investment in the shares of a guaranteeing company has been made. An insurance has been effected to cover part of this risk. Should any money be paid under the guarantee it has to be returned out of future profits of the Electric Supply Corporation, with interest.

The meeting of the company was held yesterday, Thursday.

Eastern Telegraph Co.

The directors' report for the six months ended March 31st, states that the revenue for the period amounted to £676,256, from which are deducted £179,330 for the ordinary expenses and £53,263 for expenditure relating to maintenance of cables, depreciation of spare cable, and income-tax payable abroad, leaving a balance of £443,662, to which is added £35,631 brought from the preceding half-year, making a total available balance of £479,294. After providing for income-tax payable in England, interest on loan from Eastern and South African Telegraph Co., Ltd., interest on mortgage debenture stock, and for two quarterly dividends on the preference stock, which, in all, absorb £93,146, there remains a balance of £386,147, out of which the directors have placed £10,000 to the reserve fund for maintenance ships, £195,000 to the general reserve fund, and have paid an interim dividend of 1¼ per cent. on the ordinary stock, amounting to £50,000. The directors now recommend the declaration of a final dividend on the ordinary stock for the year ended March 31st, 1905, of 1¼ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on the 27th inst., free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year. It is proposed to carry forward the balance of £1,147 to the next account. The receipts from Indian traffic for the three years ended June 30th, 1905, having reached the average "standard revenue" stipulated for under the guarantee agreement with the Indian Government, it has been decided to reduce the rate between Europe and India from 2s. 6d. to 2s. per word. The Indian Government will assist the companies in this reduction, which will be brought into operation on August 1st. From the same date the tariff between Great Britain and Aden will be reduced from 2s. 6d. to 2s. per word. An arrangement has been concluded with the Egyptian Telegraph Administration for a reduction of tariff between Europe and Egypt (1st Region) from 1s. 5d. to 1s. per word, which will also come into operation on August 1st.

The meeting of the company was held on Wednesday.

Electric Supply Corporation.

The report for the year ended December 31st last, states that the company has acquired, at par, the whole of the share capital of the Chelmsford Electric Lighting Co., Ltd., by an issue of 7,000 fully-paid shares in this company. The Chelmsford undertaking is a prosperous one, the net profits of that undertaking for last year amounting to £3,869. By the issue of the above 7,000 shares, the total share capital allotted at December 31st, 1904, was 21,492 shares of £5 each. The directors have made an issue of £50,000 of 4½ per cent. debenture stock, which amount has been secured by a deed of trust. Since December 31st last the stations at Exmouth and St. Andrews have been erected and equipped, the mains have been laid, and the supply has commenced. The capital expenditure during the year has amounted to £43,677. In order to carry out the operations of the company further capital was required, and since the closing of the accounts for 1904, negotiations have been brought to a successful issue for the placing of an additional 20,000 shares. In consequence the undertakings at Hendon, Hitchin, Falmouth and Dumbarton (in the latter case including the tramways) are being pushed forward as quickly as possible. Owing chiefly to the dividend on the Chelmsford undertaking, the net revenue account, after providing for debenture interest, &c., admits of a small balance, £216, being carried forward. It is proposed to obtain a quotation in the shares of the company on the London Stock Exchange, but the Committee of that institution require certain alterations in the company's articles of association.

The meeting of the company was held on Wednesday.

Chilian Electric Tramway and Light Co.

The report for 1904 states that the profit and loss account for the year, after payment of interest due on debentures, London office and other charges, shows a net balance to credit of £23,289, to which must be added the sum brought forward, £1,621. It is proposed to pay a dividend on the preference shares at the rate of 2 per cent., leaving £12,911 to be carried forward. During the year ending December 31st, 1904, a net profit on the operations of the tramways was made of $678,197. From this was deducted a sum of $232,857, being for a special amortisation under the headings of provisional stables and construction incidental expenses. The year 1903 showed a satisfactory development on the figures of the previous year, and the figures for 1904 show still more marked development in the successful operation of the tramways. During the year the electric lighting department earned a net profit of $276,597, against $179,723 earned in the year 1903. This shows a satisfactory increase in the business of this department, although the plant is still not utilised to its fullest capacity. During the year under review the existing track was increased by two small lines, with an aggregate length of 1,908 metres, so that the total length of track at the end of 1904 amounted to 99,200 metres.

Held Over.—Owing to heavy demands upon our space reports relating to several electrical companies are held over until next week.

Prospectus.—*Buenos Ayres Lacroze Tramways Co.*—An issue of £300,000 5 per cent. first mortgage debenture stock is now offered to the public, and the list closes on Monday. The system is about to be converted from horse to electric traction, Messrs. J. G. White & Co., Ltd., being the contractors for the work.

Barcelona Tramways Co.—An extraordinary general meeting of this company was held last week at Winchester House, Mr. J. B. Concanon presiding, to confirm an agreement between the company and the Société Financière de Transports et d'Enterprises Industrielles, Brussels, for the sale of the company's undertaking. The necessary resolutions were passed unanimously.

London Electric Supply Corporation.—The units sold for the half-year ended June 30th amounted to 6,130,461, of which 4,039,970 units were for power purposes, producing a total revenue of £62,886, as compared with 4,494,220 units sold in the corresponding period of 1904, producing £54,776.

Liverpool Overhead Railway Co.—The accounts for the past half-year show an available balance of £7,883 6s. 8d. The directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and carry forward a balance of £4,336 11s. 6d. Last year at the corresponding period a dividend of 1¼ per cent. per annum was paid on the ordinary shares, and £4,052 5s. 10d. balance carried forward.

Metropolitan Electric Supply Co.—The directors have declared an interim dividend of 5s. per share on the £5 ordinary shares, being at the rate of 10 per cent. per annum. In 1904 the interim dividend was 9s. per share, or at the rate of 9 per cent. per annum.

Waterloo and City Railway Co.—The directors recommend a dividend on the ordinary stock at the rate of 3 per cent per annum for the half-year ended June 30th last, carrying forward £658. The dividend at June, 1904, was at the same rate.

Metropolitan Railway Co.—The report for the half-year ended June 30th states that the service of electric trains between Baker Street and Harrow and between Harrow and Uxbridge has worked satisfactorily during the past half-year, and from July 1st some few electric trains have been run daily on the Metropolitan Co.'s portion of the Circle, in addition to the ordinary service of steam trains. An extra outlay for working expenses has been caused by the partial change of motive power from steam to electricity.

South Wales Electrical Power Distribution Co.—An extraordinary meeting has been called for August 5th, for the purpose of authorising the creation and issue of further debenture stock. The resolution to be submitted provides for the creation of £100,000 additional debenture stock, bearing interest at the rate of 5 per cent. per annum.

Anglo-American Telegraph Co.—The directors have resolved, after placing the sum of £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending June 30th, 1905, of 14s. per cent. on the ordinary stock, and £1 8s. per cent. on the preferred stock, less income-tax. There will be a balance of about £1,250 to be carried forward to the next account. The interim dividends in 1904 were:—12s. 6d. per cent. on ordinary, and £1 5s. on preferred, with £2,500 carried forward.

County of London Electric Supply Co.—The directors have declared an interim dividend on the ordinary shares at the rate of 4 per cent. per annum, less tax, payable on August 21st. The 1904 interim dividend was at the same rate.

Official Announcements re Companies.—The following company is to be struck off the register within three months, unless cause is shown to the contrary:—Neild's Sleeve Electric Joint Syndicate.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

São Paulo Tramways, Light and Power Co., Ltd.—75,000 shares of $100 each, and $5,500,000 5 per cent. first mortgage debentures of $500 each, Nos. 1 to 11,000.

Applications have been made to the Committee to appoint a Special Settling Day in and to grant a quotation to:—

Durham Collieries Electric Power Co., Ltd.—100,000 6 per cent. cumulative preference shares of £1 each.

And to allow the following securities to be quoted in the Official List:—

Sunderland District Electric Tramways, Ltd.—£160,000 5 per cent. first mortgage debentures of £100 each.

Westminster Electric Supply Corporation.—Interim dividend for half-year to June, at the rate of 13 per cent. per annum. Last year the rate was the same.

STOCKS AND SHARES.

Wednesday evening.

Home politics have taken the place previously occupied by foreign, as a restraining influence upon financial business. Though the General Election is for the time postponed, the knowledge of its coming in the autumn is not conducive to fresh enterprise, especially as the sloth of summer is also over the markets. Prices in the electrical division have steadiness as their dominant feature, and the number of alterations this week is still limited.

By declaring 4 per cent. on its undivided and Preferred Ordinary stocks, the Central London fulfils the general anticipation, and the Ordinary has gained a point at 92. There is £10,606 placed to the credit of the Deferred stock dividend account, this being 2 per cent. (actual) on the amount issued, so that there would seem little fear of the Deferred getting its regular 4 per cent. at the end of the year. The company's report speaks of steady advance in the number of passengers carried. There was a drop the other day in Districts to 36, and the holders who sold appeared to realise that the creation of new pre-Ordinary capital will place them farther away from a dividend than ever. Metropolitan Consolidated is 91, the market being strengthened by the numerous bears who have sold short of stock. The City and South London report breathes chastened resignation, and the price of the stock is down a point to 39. Waterloo and City at 91 shows no change upon the declaration of the dividend at the rate of 3 per cent.—the same as that of a year ago. Great Northern and City Preferred shares are 5, and it is announced that the company's books are closed for the purpose of making out the dividend warrants. Great Northern and Piccadilly 4 per cent. certificates remain at 50, Charing Cross and Euston at 50, while Baker Street and Waterloo Debenture is 102 *ex* interest.

Traction descriptions are quiet, with the exception of Buenos Ayres and Belgrano Tramways. The Ordinary have been up to 3½ within the week, a rise of nearly the fraction, but quickly relapsed to their current quotation of 3⅛ upon the issue of the directors' cautious decision to pay no interim dividend. They state that the company could distribute 1s. 6d. a share, as before, but that in view of the uncertainty as to the effect of competition on the traffics, they deem it well to await the final accounts for the year before fixing the dividend to the Ordinary shareholders.

British Electric Tractions, though unchanged at their lower level of 9, are a rather better market upon the Chairman's speech at the meeting on Monday. There was a quiet gathering this Wednesday afternoon at the Lisbon Electric Tramways meeting, despite the criticism launched beforehand at the non-payment of a dividend on the Ordinary shares of the company. London United Preference are being negotiated about 9⅜, and the Debenture stock at 99½. Business has been marked in Potteries Electric Traction Preference at 9½, the Ordinary being 9. Anglo-Argentine Ordinary at 8½, Capes at 1½, and Calcuttas at 8⅞ are very little altered. Several important propositions are privately in circulation for the supply of various districts with electric lighting, power and traction. It is said that the South Wales Power Co. will shortly be issuing some more Debenture stock.

Supply issues have slightly wobbled. Edmundson's rose ⅛ upon the absorption of the deceased account, to which we referred last week, and St. James' improved ¼ to 14 on small investment buying; but Westminsters have retrograded again to 12¾, losing part of their recovery, and Charing Cross also dropped ⅛ of the former rise, leaving the price 7 middle. County of London are better at 8½, a demand having arisen by reason of the company's favourable arrangements with the Administrative Power Bill authorities. The improvement of £1,600 in the sales of current by the South London Co. during the past quarter did not affect the shares, which are still about 3⅞. Brompton Ordinary at 10, and London Electrics at 2⅛, mark rises of 5s. each.

Closing of weak accounts has caused a fall of 32s. 6d. in Anglo-American Deferred. The Preferred, too, is ½ lower, and the Ordinary a point, in consequence of the dividend on the former being 28s. for the three months, instead of the expected 1½ per cent. Great Northerns are back to 35, but otherwise the telegraph section is fairly good. The feature is a spurt of 5 points in Eastern Ordinary, bringing the price to 147½. The company's report was very favourably received. Up to the present, however, Eastern Extensions have failed to participate in the advance. Cuba Telegraphs are up ½ at 8¾, and Westerns ¼ at 14, investors, apparently, waking up to the opportunities offered in this market for cheap purchases. Telephones are erratic, a fall of ½ in National Deferred (to 108) synchronising with a rise of ¼ in the Third Preference to 5⅞. United River Plate Telephone Preference are better at 5½, and the Debentures at 108 are ½ up. Chili Telephones at 7¼ show ⅛ rise.

Of the manufacturing shares, Crompton are easier at 1⅜, the draft upon the reserve for part payment of the dividend not being relished. At 3½ Babcock & Wilcox show no change.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1902.	1903.	1904.	Closing Quotations July 19th.	Closing Quotations July 26th.	Business done week ended July 26th, 1905. Highest	Lowest.
34,800	African Direct Telegraph, 4 % Debs.	100	4 %	4 %	4 %	98 —101	98—101	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	2¼— 2⅜	2¼— 2⅜	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	70 — 75	70 — 75	..	..
763,580	Anglo-American Telegraph	Stock	60/6	61s.	2⅜%	59 — 61	58 — 60	60	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5⅝%	106 —107	105¼—106½	106⅜	105⅝
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	14¼— 14¾	12⅞— 13⅛	14 1/16	12⅛
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	7 — 7⅛	7⅛— 7⅜	7 1/16	7 3/32
1,932,856£	Commercial Cable Sterling 500 year 4 % Deb. Stock Red.	Stock	4 %	4 %	4 %	96¼— 96¾	96¼— 98¼	97	..
16,000	Cuba Telegraph	10	6 3/32 %	10 %	5 %	8 — 8¼	8¾— 9	8⅛	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	17 — 18	17 — 18	..	..
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	3⅜— 3⅝	3⅜— 3⅝	..	..
6,000	Do. do. 10 % Cum. Pref.	10	10 %	10 %	10 %	9 — 9¼	9 — 9¼	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	100 —103	100 —103	..	..
60,710£	Direct United States Cable	20	3½%	3 %	3½%	11¼— 11⅜	11¼— 11½	..	..
74,500	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	99 —101	99 —101	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	141 —144	146 —149	147⅞	143⅞
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	89 — 91 xd	89 — 91 xd	90½	89
1,836,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	107 —109	107 —109	..	..
300,000	Eastern Extension, Australiasia, and China Telegraph	10	7 %	7 %	7 %	13⅜— 14¼ xd	13⅜— 14¾	14⅛	13 13/16
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	106 —108	106 —108	107½	..
800,000	Eastern & South African Tele., 4 % Mt. Db., Nos. 1 to 3,000, red. 1909	100	4 %	4 %	4 %	101 —103	101 —103	102¼	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	100¾—102½	100¾—102½	..	..
180,887	Globe Telegraph and Trust	10	£3-16 7*	5½%	5⅝%	10⅜— 10⅝	10⅜— 10⅝	10⅞	10 5/16
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	14¼— 14⅜	14¼— 14⅜	14 5/16	14 3/16
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	35 — 36	34½— 35⅜	35 5/16	35
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	99 —101	99 —101	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	50½— 52½	51 — 53	52½	..
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	..	3/16— 7/16	3/16— 7/16	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	111 —112	111 —112	112	111
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	107½ - 109¼	107 — 109	108¼	107½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	13⅜	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 13	12 — 13	..	..
250,000	Do. do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	5½— 5⅝	5⅝— 6	5⅝	5 11/16
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	99 —101	99 —101	99⅝	..
1,680,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	102¼—104½	102¼—104½	104	103½
179,313	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6¼%	6½%	1 5/16— 1 7/16	1 5/16— 1 7/16	1 5/32	1 7/32
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	1¼— 1⅜	1¼— 1⅜	..	..
100,000	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	97 —100	97 —100	..	..
11,839£	Reuter's	8	5 %	5 %	5 %	7¾— 8	7¾— 8	..	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	126 —129	126—129	127½	126⅝
58,000	United River Plate Telephone	5	7 %	8 %	8 %	6½— 7⅛ xd	6½— 7⅛	6 7/16	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 — 5⅛	5⅛— 5⅜	5 1/16	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	106½—108½	107 —109	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	8¼— 9	8¼— 9	..	..
30,008	West Coast of America, 1 to 30,000 and 53,001 to 53,008	2½	Nil	Nil	Nil	1/16— 1/8	1/16— 1/8	..	..
150,000	West Coast of America, 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	99 —101	99 —101	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	13½— 14	13¾— 14¼	14	13⅞
75,009	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	100 —102	100 —104	..	..
563,380	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	101 —103	101 —103	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	½— ⅝	½— ⅝	⅝	..
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	8 — 8¼	8 — 8¼	8¼	..
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	5⅞— 6¼	5⅞— 6¼	5⅞	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,803	100	5 %	5 %	5 %	101 —104	101 —104	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	4⅜— 5⅛	4⅜— 5⅛	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	4⅞— 5⅛	4⅞— 5⅛	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	2¾— 3⅛	2⅝— 3⅛	3 3/32	3
500,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	99 —103	99 —103	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	8⅞— 9⅛	8⅞— 9⅛	9	8⅞
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	11 — 11⅛	11 — 11⅛	11 1/16	11 1/16
1,000,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	5 %	5 %	5 %	122 —124	121 —123	122	121½
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	98 —100	97 — 99	98½	98
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	5¾— 6	5¾— 6	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	5¾— 6	5¾— 6	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	101 —104	101 —104	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	¼— ⅜	¼— ⅜	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	92 — 95	92 — 95	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	77 — 80	77 — 80	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	10 — 11	10 — 11	10⅜	..
40,000	Do. do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5¼— 5⅜	5¼— 5⅜	..	..
300,000	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	106 —108	106 —108	..	..
1,963,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	90 — 92	91 — 93	92	90
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	101 —103	101 —103	102½	101½
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	78 — 81	78 — 81	..	..
1,340,000	City and South London Railway	Stock	3½%	2¾%	2½%	39 — 41	38 — 40	41	40
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	1⅞— 2⅛	1¾— 2	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	94 — 99	94 — 99	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	Nil	Nil	..	1½— 1⅝	1½— 1⅝	..	..
17,139	Do. do. "A" shares, 01—017,139	5	Nil	Nil	..	2 — 2¼	2 — 2¼	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	83 — 88	83 — 88 xd	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	89 — 94	89 — 94	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	⅜— ½	⅜— ½	..	..
51,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	1⅞— 2¼	1⅞— 2¼	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	4 %	4 %	4 %	93 — 96 xd	93 — 96 xd	93½	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	9¼— 10	9¼— 10	9¾	..
200,000	Do. do 4 % Mort. Deb.	Stock	4 %	4 %	4 %	97 —101	97 —101	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	11½— 12¼	11¼— 12¼	11⅞	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	5⅜— 5⅝	5⅜— 5⅝	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	109 —111	109 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	15½— 16½	15½— 16½	..	..
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	4 %	4 %	4 %	100 —103	100 —103	..	..
37,500	Liverpool Overhead Railway, Ord.	10	1½%	1⅜%	1½%	3⅜— 3½	3⅜— 3½	..	..
10,000	Do. do. Pref. £13 paid	10	5 %	5 %	5 %	9¼— 9⅜	9¼— 9⅜	..	..
97,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	31 — 33	31 — 33	..	..
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	101 —103	101 —103	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3⅛%	3⅛%	3⅛%	90 — 92	90 — 92	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 2½ per cent. (March 9th, 1905).

SHARE LIST OF ELECTRICAL COMPANIES *(continued)*.—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1902.	1903.	1904.	Closing Quotations July 19th.	Closing Quotations July 26th.	Business done week ended July 26th, 1905. Highest	Lowest.
29,377	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	‡ 5	8 %	10 %	10 %	9¼ — 10¼	9¼ — 10¼	..	..
10,623	Do. do. 7 % Cum. Pref. ..	5	7 %	7 %	7 %	9 — 10	9 — 10	..	..
288,782	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	103 —106	103 —106	105½	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	6⅞— 7⅛	6⅞— 7⅛	7 1/16	6 13/16
80,000	Do. do. 4½ % Cum. Pref. ..	5	4 13/16 %	4 13/16 %	4 13/16 %	5⅛— 5⅜	5⅛— 5⅜	5⅜	..
40,000	Do. do. " City Undertaking " 4½ % Cum. Pref. ..	5	4 13/16 %	4 13/16 %	4 13/16 %	4 13/16— 5 1/16	4 13/16— 5 1/16	..	..
40,000	Do. do. 1903	5	..	4 13/16 %	4 13/16 %	4 13/16— 5 1/16	4 13/16— 5 1/16	..	..
350,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	104 —106	104 —106	104	..
44,436	*Chelsea Electricity Supply, Ord.	5	4 13/16 %	5 13/16 %	6 %	6 — 6½	6 — 6½	6 3/16	..
150,000l	Do. do. 4½ % Deb. Stock Red.	Stock	4 13/16 %	4 13/16 %	4 13/16 %	108 —110	108 —110	109 1/16	109
70,595	City of London Electric Lighting, Ord. 40,001—110,595.	10	5 %	5 %	6 %	10¾— 11¼ xd	10¾— 11¼	10 3/4	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	13 — 14 xd	13 — 14	..	..
400,000l	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	5 %	5 %	5 %	122 —126	122 —126	..	..
300,000	Do. 4½ % 2nd Deb. Stock, Prov. Certs., all paid ..	100	4 13/16 %	4 13/16 %	4 13/16 %	103 —105	103 —105	105	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4 1/16 %	7⅞— 8¼	8 — 9	8 3/4	8 1/16
30,000	Do. do. do. 6 % Pref., 40,001—60,000 ..	10	6 %	6 %	6 %	11½— 12½	11¾— 12¾	12 1/4	..
400,000l	Do. do. 4½ % Deb. Stock	..	4 13/16 %	4 13/16 %	4 13/16 %	111 —114	111 —114	112 3/4	112 1/2
250,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4 13/16 %	4 13/16 %	4 13/16 %	103 —105	103 —105	104	..
70,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	5½— 6 xd	5⅝— 6⅛	6	5 7/8
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	6 — 6½	6 — 6¼	6 3/16	6 1/16
300,000l	Do. do. 4½ % 1st Mort Deb. Stock ..	100	4 13/16 %	4 13/16 %	4 13/16 %	105½—107½ xd	105½—107½	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12 %	12 %	11½— 12½	11¼— 12¼	..	..
136,000	Do. do. do. 4 % Debenture Stock ..	Stock	4 %	4 %	4 %	98 —101	98 —101	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	1¾— 2¼	1⅝— 2⅜	..	..
60,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	4½— 5¼	4½— 5¼	..	..
371,895	Do. do. do. 4 % 1st Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	99 —102	99 —102	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7 1/16 %	8 3/16 %	10 %	9¼ — 10	9 1/16 — 10	9 1/16	9 1/16
76,121	Do. do. 4½ % Cum. Pref. 1—71,106, £3 paid ..	5	4 13/16 %	4 13/16 %	4 13/16 %	5⅝— 5⅞	5⅝— 5⅞	5 13/16	5 13/16
220,000l	Do. do. 4½ % 1st Mort. Deb. Stock	..	4 13/16 %	4 13/16 %	4 13/16 %	109 —113	109 —113	..	..
250,000l	Do. do. 3½ % Mort. Deb. Stock Red.	Stock	3 13/16 %	3 13/16 %	3 13/16 %	98 —100	98 —100	100 1/16	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4 13/16 %	4 13/16 %	4 13/16 %	99 —101	99 —101 xd	99 1/2	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	14 — 15	14 — 15 xd	..	..
59,000	Do. do. 4 % 1st Mort. Deb.	100	4 %	4 %	4 %	100 —102	100 —102	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14 13/16 %	14 13/16 %	14 13/16 %	13½— 14½	13½— 14½	..	..
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	8 — 9	8 — 9	..	..
150,000l	Do. do. do. 3½ % Deb. Stock Red. ..	100	3 13/16 %	3 13/16 %	3 13/16 %	97 — 99	97 — 99	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2 13/16 %	4 %	4 %	2½— 3	2⅝— 3	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	78 — 82	78 — 82	..	..
65,000	South London Electricity Supply, Ord.	5	13 13/16 %	3 %	4 %	3¾— 4	3¾— 4	3 13/16	3 13/16
100,000	South Metropolitan Electric Light and Power (Ord	1	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	..	..
50,000	*(Late Blackheath and Greenwich* 7 % Pref.	1	Nil	7 %	7 %	1¼— 1⅜	1¼— 1⅜	..	..
100,000	*Dist. E.L.Co.)* 4½ % 1st Deb. Stock	100	4 13/16 %	4 13/16 %	4 13/16 %	106 —109	106 —109	107	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	4⅝— 4¾	4⅝— 4¾	..	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5 3/32	..
200,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	100	..	..	4 13/16 %	104 —106	104 —106	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	13 13/16 %	14 %	12 — 13	11⅞— 12¼	12¼	12
28,151	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	6⅛— 6⅜	6⅛— 6⅜ xd	6⅜	..

Shares not officially quoted :—Mackay Companies, ord., 41—42. Pref. 75—76.

* Subject to Founders Shares ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, July 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	per cwt.	22/-	..
a " Oxalic	per cwt.	32/-	..
a " Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a " "	per ton	£30	..
a Bleaching powder	per ton	£5 5	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a " (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£20	..
a Lead, Nitrate	per ton	£25	..
a " White Sugar	per ton	£31	..
a " Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a Potassium Bichromate, in casks	per lb.	3d.	..
a Potash, Caustic (75/80 %) ..	per ton	£22	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	185/-	38/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a " Recovered	per ton	£5 10	..
a " Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a " Crystals	per ton	£3	..
a Sodium Bichromate, casks ..	per lb.	2½d.	..
a " Cyanide	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£130	..
b " Wire, in ton lots ..	per ton	£168	..
b " Sheet, in ton lots ..	per ton	£166	..
b Babbitt's metal ingots	per ton	£43 to £140	..
c Brass (rolled metal 2' to 12') basis	per lb.	7¼d.	..
c " Tube (brazed)	per lb.	9½d.	..
c " " (solid drawn)	per lb.	8½d.	..
c " Wire, basis	per lb.	7¾d.	..
c Copper Tubes (brazed)	per lb.	10½d.	..
c " " (solid drawn) ..	per lb.	10¼d.	..
g Copper Bars (best selected) ..	per ton	£81	£1 inc.

METALS, &c. *(continued)*.		Latest Price.	Fortnight's Dec. or Inc.
g Copper Sheet	per ton	£81	£1 inc.
g " Rod	per ton	£81	£1 inc.
e " (Electrolytic) Bars ..	per ton	£71 10	£1 inc.
e " " Sheets ..	per ton	£87	..
e " " Rod ..	per ton	£81	..
e " " H.C. Wire	per lb.	9½d.	½d. inc.
Ebonite Rod	per lb.	3/3	..
" Sheet	per lb.	3/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	5/4½ to 5/5½	..
i Iron, Charcoal Sheets	per ton	£18	..
i " Pig (Cleveland warrants)	per ton	46/-	6d. inc.
i " Forgings, according to size	per ton	From £11	..
i " Scrap, heavy	per ton	47/6 to 50/-	..
i " Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£14 7 6	7/6 to 10/- inc.
g " " Sheet	per ton	£16	10/- inc.
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£7 7 6	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d " " " medium	per lb.	2/6 to 4/-	..
d " " " large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/1 to 1/3	..
p " rolled bars & rods	per lb.	1/1 to 1/3	..
p " " strip & sheet	per lb.	1/3	..
o Platinum	per oz.	84/-	..
e Silicium Bronze Wire	per lb.	10½d. to 11½d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i " " in bars		£15 to £40	..
g Tin, Block	per ton	£150 10 to 9	£7 10 to £8 inc.
n " Wire, Nos. 1 to 16	per lb.	1/	1d. inc.
p White Anti-friction Metals— "White Ant" brand	per ton	£43 to £65	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j " 6 lea. Flax	per lb.	5¾d.	..
j " 3 ply 10 lbs. Russian ..	per lb.	4½d.	..
j " 10 lbs. Russian, single ..	per lb.	4¼d.	..
j " 180 lbs. Jute rove ..	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£27 15	..

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons, Ltd.; *d* F. Wiggins & Sons; *e* Frederick Smith & Co.; *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

Annual Outing.—On Saturday last the employés of MESSRS. RAWLINGS BROS., LTD., of South Kensington and Sloane Street, &c., held their annual summer outing at Hastings. Dinner was served at the Concert Hall, Warrior Square. The loyal toast was proposed by the chairman, Mr. W. R. Rawlings, and in proposing the toast of the "Employés," he regretted that, owing to the numerous country jobs on hand in Ireland and elsewhere, the number of those present was not half what it might have been. Mr. E. G. Nicholson, who responded on behalf of the employés, thanked Mr. Rawlings, and assured him of the confidence of the employés in their directors. Mr. T. S. Rowden next proposed the toast of the "Chairman and Managing Directors." Mr. J. J. Rawlings, responding on behalf of the latter, referred to the question of the insurance of the employés, and reminded them that by an extremely small contribution they were assured of compensation in the event of accident, whether the firm was legally liable or not, and this arrangement had proved most beneficial. He urged them all to extra effort owing to the increased severity of competition and consequent reduction of profits. The chairman of the company also thanked Mr. Rowden, and expressed satisfaction at the amount of business being done in spite of the general depression in trade, and he urged all present to look after details, and so support the management. After luncheon the party went for coach rides and enjoyed the many other attractions of the town.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JUNE, 1905.

We give herewith the June returns of electrical business in connection with the United Kingdom.

A reference to the totals will show that the exceptionally satisfactory returns of the month of May have not been maintained, although much improvement is still apparent over the April figures.

For the month of June, the exports amounted to some £129,552, a decline roughly of £9,000; this decline is fairly distributed over the majority of the items, with the exception of electrical machinery and telegraph material, the former showing a reduction of £15,000 on the month, and the latter an increase practically similar in amount—the telegraph exports for May, registered as such, being almost negligible in value.

Turning to the imports, which totalled £105,210, or a reduction of £17,000 on the May returns, declines are apparent under all headings, except electrical machinery and batteries, the former of which shows an advance of some £11,000 in value.

The re-exports were fractionally higher than in May, amounting to some £8,556. In addition to the spasmodic rise in telegraphic exports, it is satisfactory to note that our exports of telephone material have this month somewhat exceeded the imports in that line, also that our tramway material exports still maintain a substantial value.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electric light and power cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telephone material and electric bells.	Electrically-driven machinery.	Tramways apparatus and materials.
	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark... ...	604	47	135	65	188	1,321	220	...	1,081	966	...
Germany	107	...	5	5	5	160	1	13	85	...	...
Netherlands...	91	1,848	138	...	5	151	24	...	...	28	...
Dutch Borneo and Indies	150	...	168	...	22	...	...	...	...	...	...
Belgium	97	...	50	...	33	838	...	...	205	72	...
France	357	64	159	...	12	374	...	...	...	145	...
French Indo-China and West Africa	29	...	10	25	...	20	...	...	...	...	...
Portugal and Portuguese Africa	96	55	21	...	...	300	...	...	156	...	...
Spain and Canary Isles	147	120	17	31	...	673	...	...	...	...	...
Italy and Austria-Hungary	6	...	...	...	...	377	3	...	...	...	...
Egypt	1,288	...	79	11	...	37	...	...	106	11	...
China and Siam	123	77	176	25	4	814	...	...	...	193	...
Japan	204	1,619	114	...	...	5,789	238	...	...	...	219
U.S.A.	23	...	10	25	9	155	1	...	29	...	...
Mexico and Central America	4	7,190	...	...	...	584	...	...	...	565	...
Columbia, Peru and Uruguay	...	...	45	...	...	...	...	...	212	...	...
Chili	...	252	117	98	...	...	58	1	111	...	...
Brazil	1,712	...	13	34	10	676	534	4	...	...	...
Argentine	1,490	1,377	184	150	11	1,223	846	...	584	...	...
Channel Isles, Gibraltar and Malta	105	132	98	...	...	233	...	...	...	...	...
British West Africa	27	8	94	12	6	...	8	5	50	...	...
Cape of Good Hope	2,213	1,487	782	7	396	859	1	18	2,312	113	...
Natal...	930	1,218	887	368	965	3,550	484	...	150	3,500	...
Zanzibar, Brit. Cen. Africa, Mauritius and Aden	3	7	58	...	...	146	...	36	5	...	...
India...	2,270	5,205	2,178	581	250	3,950	69	198	624	435	1,424
Burmah	...	...	5	23	...	682	...	...	5	...	...
Ceylon	26	49	75	...	69	...	...	...	109	...	...
Straits Settlements and Labuan	473	68	283	36	13	3,346	82	...	107	29	...
Hong Kong	79	703	53	...	...	...	...	...	...	...	4,260
West Australia	217	27	101	261	203	278	...	...	9	412	...
South Australia	45	...	79	...	20	93	10	...	...	...	...
Victoria	156	392	132	...	...	2,171	...	...	31	...	113
New South Wales	1,918	291	360	90	8	1,973	164	...	...	...	...
Queensland	...	45	20	...	...	1,797	13	...	...	167	...
Tasmania	4	...	136	...	...	...	...	...	343	...	...
New Zealand and Fiji	248	924	596	41	402	1,297	18	...	5,207	...	2,360
Canada	17	340	42	38	...	76	18	...	27	...	...
British West Indies and British Guiana ...	72	8	3	2	...	...	52	...	...	...	...
Total, £	15,331	23,553	7,433	1,928	2,631	33,943	2,844	275	11,548	6,636	8,376

Telegraph exports: Marconi apparatus, £15,054, Russia.

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£
Russia, Norway, Sweden and Denmark... ...	21	...	...	43	...	1,552	194	8	9,196	...	...
Holland	5,007	378	849	82	...	4,763	...	4,167	33	...	...
Germany	4,689	1,450	336	148	150	15,744	297	692	1,462	...	...
Belgium	12,009	443	...	1,202	13	10,169	45	445	307	...	...
France	8,773	702	296	303	660	1,302	1,314	2,421	...	...	...
United States	3,438	...	235	837	76	16,787	1,970	13	29	47	...
Canada	13	...	...	...	...	100	...	...	...	...	...
Total, £	33,950	2,973	1,716	2,615	899	40,417	3,820	7,746	11,027	47	

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	1,655	38	177	...	27	4,994	85	25	2,074	181	...

Total Exports:	Total Re-Exports:	Total Imports:
£129,552	£8,556	£105,210

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

ELECTRIC TRAMWAY AND RAILWAY EXHIBITION, 1905.

Description of Interesting Exhibits.

(*Continued from page* 87.)

Trolley Retrievers.—Since printing our last issue we have been reminded of another retriever, which escaped our notice at the Exhibition, and is worthy of attention. Unlike the Ross & Hindley apparatus, the retriever illustrated below (fig. 13) which is supplied by the National Rail and Tramways Appliances, Ltd., Liverpool, is external to the standard and controls the trolley rope itself, being in that respect similar to the Wilson "catcher." It is, therefore,

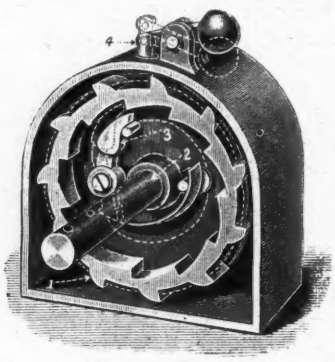


Fig. 13.—National Trolley Minder.

applicable with safety only to centre running lines. The following description of its action has been supplied by the makers:—

1 is a ratchet wheel to which is attached one end of a strong flat spring, the other end being attached to the spindle (2).

3 is a pawl fixed to the rope drum which is controlled by a light spring for the purpose of taking in and letting out the trolley rope, and controls any length of rope up to 16 ft., always keeping the rope tight, but allowing the trolley head to follow the wire. Should the wheel leave the wire the sudden upward jerk causes the point of the pawl to move outward and engage with the teeth on the inner side of the ratchet wheel, the position of the pawl being indicated by dotted lines.

It will be seen that when the pawl comes in contact with the ratchet wheel considerable pressure is exerted, and there is a tendency to move the ratchet wheel in the direction in which the rope drum is moving; this releases the catch (4) which holds the pulling down spring in tension, and the trolley cord is at once wound round the drum, always pulling the trolley head from 10 to 15 in. below the wire.

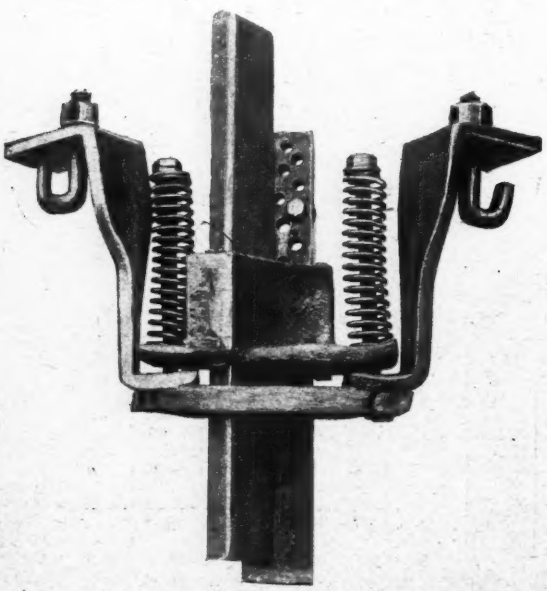


Fig. 14.—Pringle's Rail Cleaner.

It will be seen that the tension on the pulling down spring has to be restored each time the pull down operates. This is very simple, and is done by pulling the trolley rope in an upward direction a distance of from 15 to 18 in., and replacing the catch by pressing it in a downward direction.

The re-setting only requires about two seconds, and is only necessary when the pull down has operated, not when changing the trolley from one end of the car to the other.

The same firm make the simplest possible form of retriever, which consists of a weight attached to the trolley rope and hung in a tube on the dash. When the trolley leaves the wire the weight is jerked off its supports, and being sufficiently heavy to overcome the upward pressure at the end of the pole, pulls it down below the wire to any desired extent. This is on the same principle as the retriever described in our issue of December 30th, 1904.

Rail Cleaners.—We suppose that rail cleaners are as necessary for the economical working of a tramway as many an appliance for coal saving with which tramway generating stations are equipped. In the most numerous cases, where the tramway department or company buys energy from another department or from an outside source, the inducement to run a car-mile on as little energy as possible is even stronger than in the alternative case.

But apart from the direct economy which must result from clean rails, there are other considerations to which weight should be attached. To begin with, a dry, dirty rail means noise approaching that heard when cars run over corrugated rails; it means flashing, which alarms the other users of the street, and has often brought about an action for damages; and it means partial or total "grounding" (as the insulating of the car-wheels from the rails is called, most inaccurately), with its well-known objectionable consequences. Then a clean dry rail never bred a dirty wet rail, which is synonymous with a greasy rail, and which has caused more serious accidents, and has cost our tramways more in repairs and renewals, than any other evil under the sun.

Why, then, suffer from dirty rails, when by cleaning, either constant or intermittent, according to the conditions of roads and traffic, a clean rail is within the reach of all?

Is it that the one or two rail cleaners which have been offered up to now have been ineffective or expensive? Or is it that the gravity of the problem has not been appreciated so fully as it deserves? Whatever it is or is not, we venture to prophesy that this Tramway Exhibition will have sent many a man home with the knowledge that good track cleaners can be bought cheaply and that they can be made effective.

Messrs. Geo. W. Green & Co., Crown Works, Lambeth, had on their stand a cleaner which is unique in several respects. It is the invention of Mr. P. J. Pringle, general manager of the Burton Tramways, and is the outcome of dissatisfaction with the work of certain other cleaners. Mr. Pringle appears to have known just what he wanted, and hammered away until the apparatus illustrated in fig. 14 was evolved. That apparatus bears the marks of an experiment, and we believe that it is the last of a long series, and has been in constant use at Burton for some months.

Those who can see at a glance the points of a rail-cleaner will not need to be told that this one differs from all in having two independent cutters, one for the groove and one for the tread, and differs from most in being set vertically to the rail-head, while the tread cutter has its edge held at an angle of 45° with the track, so that the dirt is thrown clear of the rail, and the cutting is done with the least effort. The pressure of the cutters on the rail is obtained, not by springs or direct pull, but by the free weight of the cutting bars themselves.

To Mr. Pringle is due the credit of the discovery that the wear caused by the groove on the scraper is about six times that caused by the tread, and it will be evident to every one that for only one-sixth the life of a one-piece scraper can that part which runs in the groove be of any service. Now, it is the flange and groove friction which is responsible for most of the excess drawbar-pull per ton

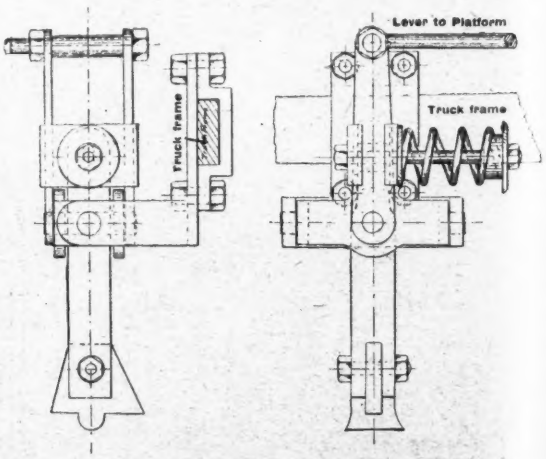


Fig. 15.—"National" Rail Cleaner.

which is required by a tramcar over a railway car, and it is therefore more important that the groove of a tram-rail shall be kept clean than the tread, although we do not wish to minimise the considerable importance of the latter.

We need not dwell further on this ingenious appliance than to call attention to the self-feeding of the cutting bars and the simple, certain way in which the bars are permitted to override a stubborn obstacle without damage to any part of the cleaner. We are informed that the device is now made to a pattern that will fit any type of truck without alteration.

The National Rail and Tramway Appliances Co., Ltd., showed the cleaner which is illustrated above (fig. 15). It is a simple

contrivance, and is attached to the truck frame in the usual way. It is under the control of the driver, and can be removed from and replaced on the track while the car is in motion. It will work

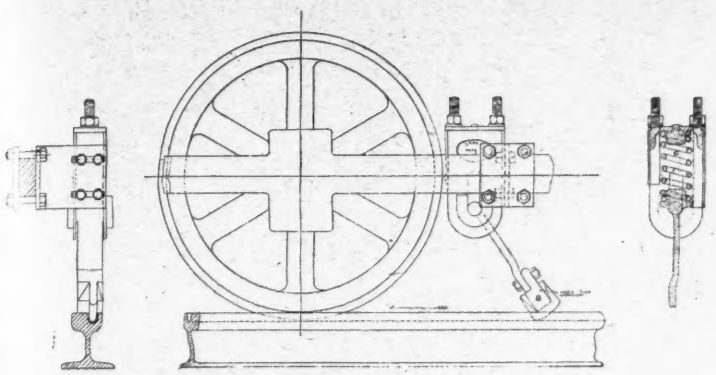


Fig. 16.—Jerrard Rail Cleaner.

over points, crossings and curves, and is constructed substantially of cast-steel and wrought-iron. The makers consider that it should be fitted to every tenth car or thereabouts, in order to keep the rails properly clean, but that must depend, of course, on the frequency of the service. Like all other cleaners, it will be found useful in winter to keep the rails free from snow and ice, and will reduce the quantity of salt which has to be used for thawing purposes, with such disastrous effects on the electrical equipment. The cutter is renewable.

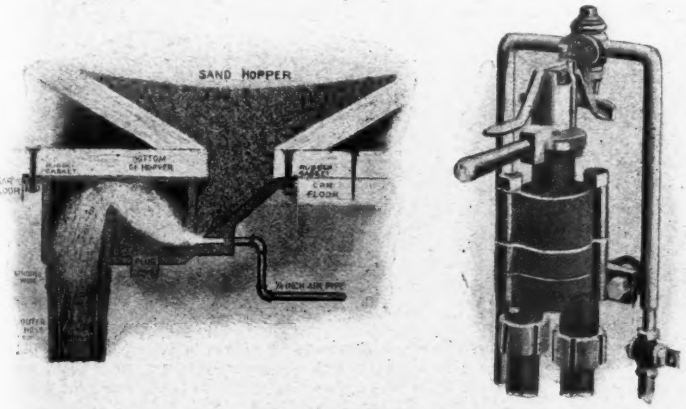
The British Griffin Chilled Iron and Steel Co. exhibited their Jerrard rail cleaner, which has been in use on many British lines. It was one of the first cleaners to be used on electric cars, and reference to fig. 16 will show that its familiar form has not been changed during the last year or two.

Sand Boxes.—It is a trite saying that the safety of car and passengers depends on the sand box more often than managers would like to own, even to themselves. The sand box is the first article against which many a tyro in tramway work has stumbled, and the invariable result of 99 per cent. of the concussions has been an elaborate contrivance full of valves and elbows, joints and knuckles, bell cranks and pedals, which is capable of demonstrating to all and sundry who visit the car-shed, or the office, or the Exhibition, that it will pass anything, from grit and wet sand to bundles of tickets. Some of these find their way on to cars "for trial under practical conditions," that awful bogy of the inventor; and all sooner or later find themselves shouldering cast-off gears and the rejecta of the smith's anvil.

All the time there goes on the real need for something more than the flat valve, which has a knack of sticking open or remaining closed at awkward moments and for causes various, but there is hardly anything but that one type of flat-valve sand box in use in Great Britain at the present moment.

New sand boxes at the Exhibition were in the hands of car builders or tramway supply manufacturers of some repute, and all were designed by men whose knowledge of the requirements to be met was not that of the tyro afore-mentioned.

The British Electric Equipment Co., in other words, the Ohio Brass Co., U.S.A., produced the "Nichols-Lintern Sander," illustrated below in section (fig. 17). Considering the limited use of pneumatic power for any purpose on English tramcars, this pneumatic sander will not attract much attention at present, but there are a few systems on which air-brakes are in use, and it is



Figs. 17 and 18.—Nichols-Lintern Sander and Handle.

quite possible that there will be more in the future, especially where cars grow heavy and speeds high.

The pneumatic sander has many beguiling features. For instance, the makers say that the Nichols-Lintern sander bears the same relation to ordinary sanders that the modern air-brake does to the old form of hand brake. There is the convenience of having the sand always under instant control, the certainty of operation, and the absence of all movable mechanism. Fig. 18 shows how handy the sand air-handle is, and reminds us that in an emergency the driver has not to think which are his hands and which are his feet, but can keep both feet free for jumping, unless he likes to sound the gong with one of them, while with one hand he throws the controller handle to "off," and the air-brake handle to "emergency," not worrying at all about the sand, for the air-brake handle interlocks with the sander handle in that position, and turns on full sand automatically.

The makers say that, despite a popular opinion to the contrary, a car equipped with a pneumatic sander and an air-brake will use less air than a car equipped with air-brake only, the reason being that the braking conditions are better with the pneumatic sander than without, and, in consequence, the car is pulled up without the use of so much air.

On cars where air-brakes are applied already a pneumatic sander will cost but little to instal

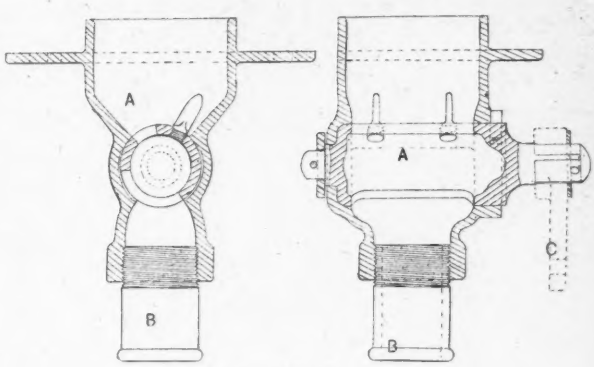


Fig. 19.—Hurst-Nelson Sand Valve.

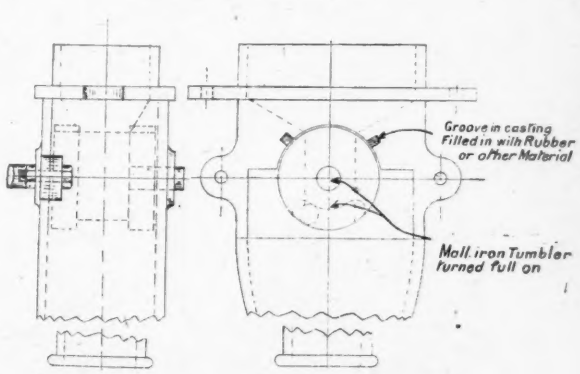


Fig. 20.—Endean's Patent Sand-Box.

and has many advantages to recommend its adoption in place of the foot-operated "motorman's curse."

Messrs. Hurst, Nelson & Co. displayed a patented sand-valve which we were unable to examine closely, but which is shown in cross-section in fig. 19.

The National Rail and Tramway Appliances Co. showed a swivelling sand-pipe connection, which enables sand to be dropped on the rail from a bogie car when rounding curves.

Messrs. Brecknell, Munro & Rogers had on view Endean's patent sand-box, which is illustrated above (fig. 20). The valve box consists of an iron casing containing inlet and outlet ports on which works a cylindrical valve. This valve will take all grades of sanding material, and can be opened full bore with one stroke of the pedal, or can be adjusted to give the proper flow for any grade of sand. It gives a direct flow, is instantaneous in its action, and can be operated successfully with wet or dry sand. No alteration to the car is required to fit this valve and gear in place of any other.

The Brush Co., who should have gathered more practical experience about cars and their accessories than any firm in

existence, demonstrated the cure of all sanding troubles by means of a working full-sized model of Leech's valve, of which fig. 21 is an illustration. In the words of the patentee, the sand gear consists of a hopper to contain the sand, secured to a combined carrier and valve guide arranged for bolting to the floor of the car. The carrier is formed with ventilating holes through which any obstruction may be removed. A hoppered casting is secured to the carrier, recessed at the top to take the steel valve plate, and shaped at the bottom to receive the hose pipe which conveys the sand to the rail. The valve is made with a

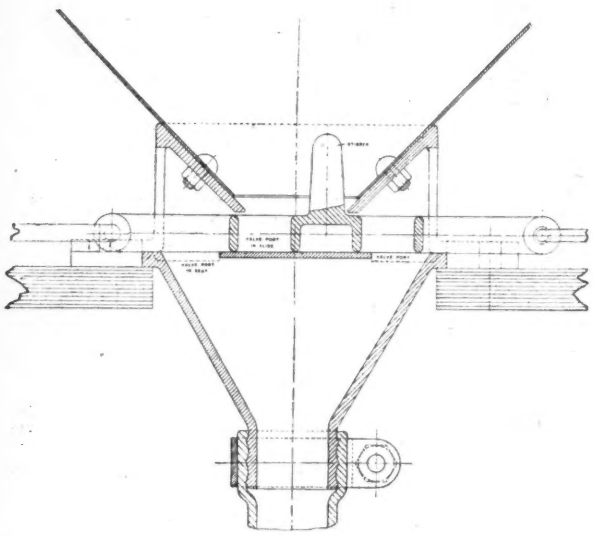


FIG. 21.—LEECH'S SAND VALVE.

central portion, having a tongue on its upper surface to loosen the sand contained in the hopper. Two cells are arranged, one on each side of the central portion, and the ends of the valve are formed into arms which project outwards, one arm engaging with the release spring, and the other with the mechanism for operating the valve by means of a pedal on the driver's platform.

When the hopper is filled with sand, a portion rests upon the valve plate in the recess in the valve, which is held in the closed position by means of the spring. When the driver depresses the pedal, a valve is moved forward, and the sand within the cell is pushed over the edge of the valve-plate, and falls down through the hose-pipe to the rail. Meanwhile the other cell fills with sand, and, upon the driver releasing the pedal, the sand contained in the second cell is pushed over the other edge of the valve-plate, falling down through the hose-pipe to the rail, the first cell in the meantime becoming charged with sand. The valve discharges a definite quantity of sand both on the forward and backward stroke. It is ventilated, and thus free from the objection of moisture creeping into the sand in the hopper, and, in case any obstruction prevents the free passage of the sand to the rail, the obstruction may be readily removed.

The gear being fixed above the floor, the valve is entirely guarded against wet and mud thrown from the wheels, which is such a source of trouble in the ordinary types of sand gear. It has been applied to, or is on order for, 350 cars.

Folding Steps.—One has the satisfaction of knowing that if one is to be killed by a tramcar the B. of T. has done its best to make that death as easy as it knows how. We anticipate the time when it will be impossible for a tramcar to treat even a would-be suicide with the slightest discomfort. All comers, in fact, will be picked up by the guard and a brandy and soda supplied automatically.

Since the last Exhibition the folding step has arisen, possibly from the ashes of extinct lifeguards. The term includes not only folding steps, but lifting, bobbing, twisting, turning and all kinds of acrobatic steps. If the Exhibition had been postponed for six months, we believe there would have been an epidemic of folding steps, such as to require an additional B. of T. inspector to approve them all.

The folding step was introduced at the recommendation of the B. of T. in order that there should be free passage for a body under the platform. It was an act in favour of the lifeguard. Henceforth that machine has the sole prerogative to kill or catch.

MESSRS. BRECKNELL, MUNRO & ROGERS gave performances at frequent intervals with the "Leicester" folding step. This most ingenious invention makes it quite impossible for the most forgetful of motormen or the most excited of passengers to break his neck or any lesser member by not minding the step. We illustrate it in figs. 22 and 23.

When the step is down and the gate open as shown, lever B lies alongside the car end and acts as a hand-rail.

The lever B is locked in this position by spring bolt G engaging with cam L, which prevents vertical rail A being revolved.

On closing the gate, catch J on gate presses spring bolt G back and allows lever B to be brought forward in line with the gate; if lever B is not so moved the gate will not be locked and will fly open. The movement of lever B into the line of the gate as shown by dotted lines, fig. 23, would raise the step and at the same time lock the catch J, by bringing cam L into the slot in gate catch J; at the same time the pedal lever N engages in the cam M at base of vertical rail A, thus securely locking the step in position. The face M of the cam having been given a quarter of a turn is hooked behind the pedal lever N.

The gate cannot again be opened till the step is lowered, as to open the gate the cam M on vertical rail A must be released and lever B replaced alongside the car end, as shown in fig. 22, unlocking catch J. This movement lowers the step by means of the pinion D keyed to trunion F, and quadrant E keyed to vertical rail A. The cam M and pedal lever N then automatically engage, and the step is locked in position as shown, for passengers to enter the car; meanwhile the gate being free has automatically collapsed (by means of spring O), leaving the entrance open.

To fold up the step when required, the gate must be first closed and catch J inserted in locking box, the handle B is then pulled out from end of car to a position in line with gate, when all the other movements above described automatically take place.

MESSRS. PHILIPSON have patented an automatic step which is designed to act both as a step and a side guard, while it obviates the gap in the platform which would be caused by the folding step pure and simple. If an object too large to pass under the step in its normal position falls in front of the car, only 3 lb. pressure is required to lift the step and let the object pass on to the life-guard. This being done, the step drops into its normal position. The force which is required to raise the step may be determined by the apparatus employed under the seat of the car, by which the step can be held in balance. The step may be fixed in the up position by means of a lever and catch placed in such a position that when the driver closes the gate, the step cannot be let down, but can be used as a step in either position.

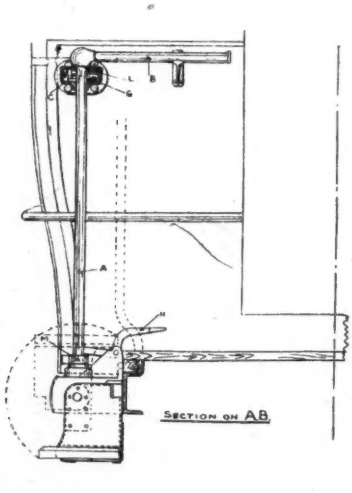


FIG. 22.—END VIEW.

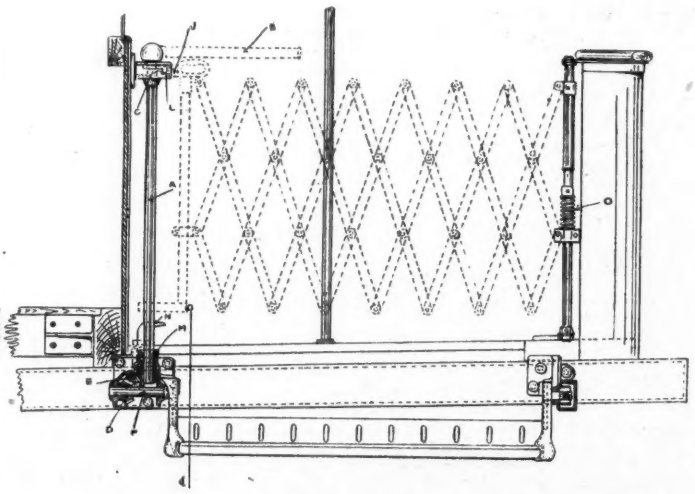


FIG. 23.—SIDE VIEW OF LEICESTER STEP.

Messrs. Hurst, Nelson & Co. had equipped their Kilmarnock car with a patent step. As the illustration (fig. 24) shows, this step gets itself out of the way by a direct lift up to a level with the platform bearers, and it has the same advantage as the Leicester

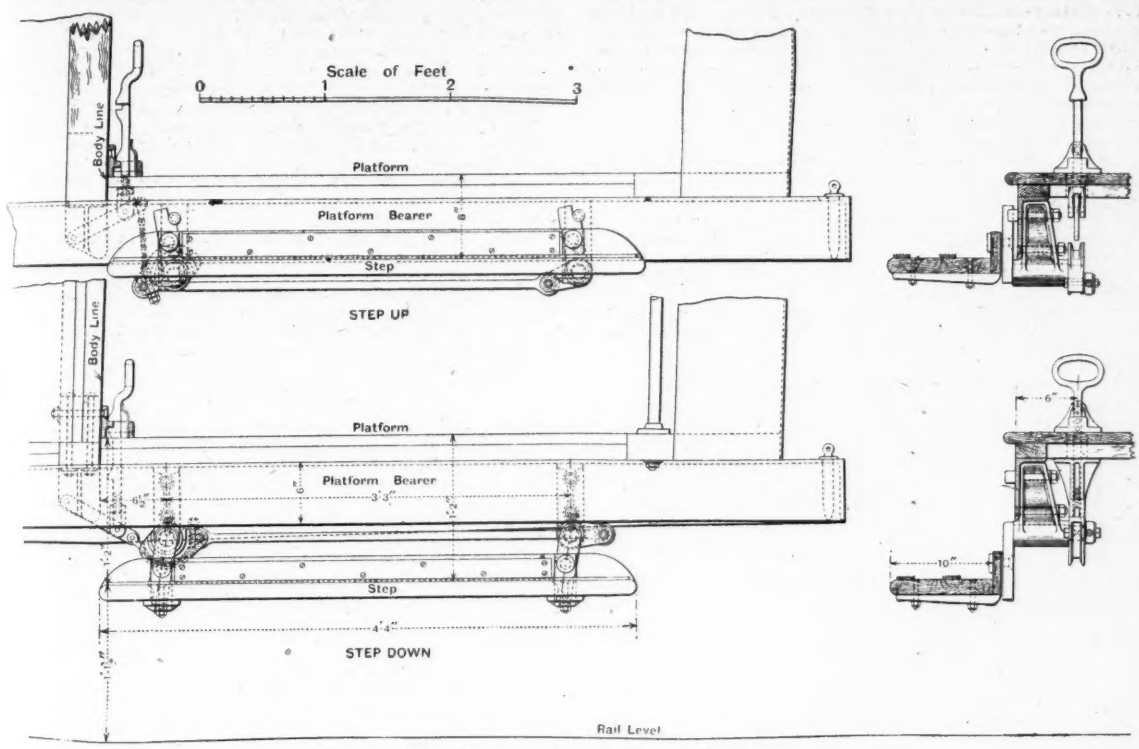


Fig. 24.—Hurst-Nelson Patent Step.

step in being always a step, and never a vertical board, but it does not attempt the intricacies involved in interlocking with the gate.

The Brush Co. were among the first to comply with the B. of T. recommendation, and their step was to be seen fitted to the two cars on their stand. Fig. 25 gives an idea of the simplicity and solidity of the design.

(To be continued.)

REPORT OF ROYAL COMMISSION ON LONDON TRAFFIC.

(Concluded from page 122.)

The Commission divide railway passenger traffic into (*a*) long distance; (*b*) suburban; and (*c*) urban; (1) long distance; (2) short distance; and point out that, as regards *a*, *b* and *c* (1) no means of transport other than railways provide the facilities required.

The needs of London in the matter of railway accommodation, according to the Report, are:—

(1) Main trunk railways connecting London with the entire railway system of the country, with adequate running and terminal accommodation, and sufficient services for the convenient and speedy conveyance of long-distance passengers, and for the carriage of merchandise traffic.

(2) Railways to every suburban district in the neighbourhood of London, with full running accommodation to enable trains to be run at quick speed and short intervals, especially during "rush hours," to provide for the conveyance of suburban passengers without overcrowding, and with convenient connections with all urban railways and tramways, and with tramways in the suburbs.

(3) Railways in, through, across, and round the central area of London to provide, not only for urban movement at higher speeds, and for longer distances than those which can be conveniently provided for by street tramways and omnibuses, but also for the distribution of suburban and long-distance passengers to the fullest practicable extent.

The requirements of long-distance traffic only affect the inquiry from the point of view of the location and adequacy of the main terminal stations, the sufficiency of the street accommodation adjoining, and means of distribution of passengers arriving at those terminal stations, and the convenience of the train services connecting the various termini. The needs of urban and suburban traffic are, the Commission point out, wholly different in character, and many of the mistakes of the past have been due to not keeping this distinction in mind with sufficient prominence. The considerations affecting location, accommodation and working of urban and suburban railways are radically different, and, to some extent, conflicting; and the absence of comprehensive design in the railway system in London is nowhere more apparent than in the confusion which has arisen from not distinguishing, with sufficient clearness, between the requirements of these different classes of traffic. Railways intended for urban traffic have been used, and partly designed, for suburban traffic to an extent, and under conditions, which have adversely affected their utility for both purposes. It is of vital importance not to attempt to use urban railways in any way, or for any purposes, which may prevent the running on them of train services of maximum frequency.

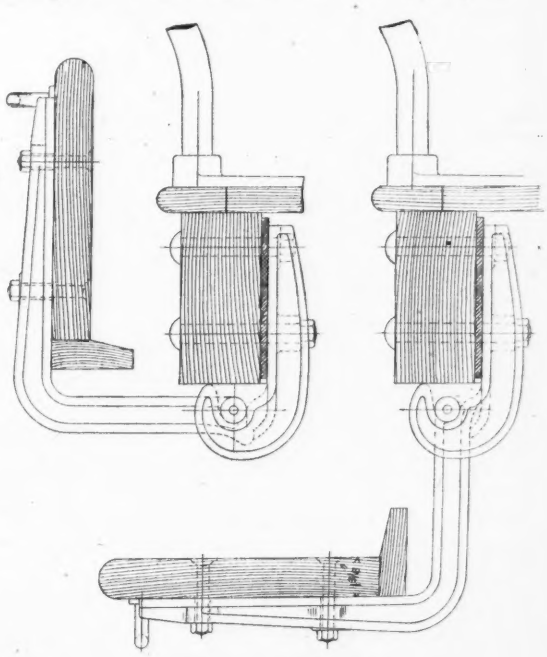


Fig. 25.—Brush Folding Step.

The Report then discusses individually the adequacy of the central urban facilities of transport for the distribution of passengers arriving at the main line stations in London, and states that, after the underground railways now under construction or in process of electrification are in operation, all the main line terminals, with the exception of Paddington, Victoria, and Fenchurch Street, are sufficiently provided for. To meet the case of Victoria, the Commission recommend the extension of the North-West London Railway from Marble Arch.

In regard to urban railways, the conclusion is stated as follows:—

Sec. 143.—"We have come to the conclusion that, when the 'tube' railways already authorised have been completed, with the addition of the line we have suggested from Victoria to Marble Arch, the most pressing requirements of railway communication within the central area, as distinguished from the suburbs, will have been fairly provided for. We think, however, that greater attention should be paid to providing interchange stations, wherever lines running north and south intersect those running east and west; and that, wherever it is possible, this accommodation for the public should be afforded."

In regard to suburban railways, the only specific recommendation is the following:—

"We think that, in regard to both the suburban and central urban railway systems, there should be better connection to the north-east of London; and better connection between the suburban systems on the east and the suburban systems on the west, with the object of improving central urban communication, and providing passengers with fuller facilities than they now possess, by convenient interchange stations, for reaching all principal points within the central area erved by the central urban railways."

The Commission then discuss the practicability of securing the construction of further underground railways in London. They express their reliance on private enterprise in the following terms:—

"A sufficient number of successful underground railway schemes, however, remain to justify the hope that there is no need, as yet, to make an alteration in the present system of private promotion in the direction of looking to public sources for any part of the funds required for railway enterprise, unless undue financial obligations are thrown upon the railway undertakings, either in respect of works or compensation, or in regard to the carriage of passengers at unremunerative fares, or otherwise.

"All that in our judgement is necessary, is to see that no discouragement shall be created for private enterprise by the system of procedure under which railway undertakings are authorised, or by the imposition of undue burdens proposed on, or exaction of impossible conditions from, promoters."

If public assistance is inevitable (and the Commission think that neither the construction of unremunerative underground railway lines, nor the running of unremunerative trains should be laid on railway companies), the Commission suggest various methods of assistance—the remission of rates, direct subscription to capital or guarantee of receipts by local authorities, permission to railway companies to acquire large tracts of land before development, and permission for construction underneath the parks.

The Commission then discuss the relative advantages of tubes and shallow railways under the four heads of:—

1. Economy of cost of construction.
2. Avoidance of interference with street traffic.
3. Avoidance of damage to property.
4. Ventilation, convenience of access, &c.

But, although they report in favour of the shallow railway as against the tube, they recognise that the construction of the former is in many cases quite impracticable.

The Commission state that all large systems of mechanical traction can be worked most economically, and with the greatest advantage to the public when they are under one and the same management, and believe that amalgamation can be carried out in such a way as to be profitable to the shareholders and advantageous to the public, but they think that it should only be sanctioned on terms and conditions which fully secure the interests of the public.

In this connection they state that their attention has been called by the London County Council to the case of the Underground Electric Railways Co. of London, Ltd. The London Underground Electric Railways Co. is not a statutory company, but the enterprises which it now controls or influences were, or are being, constructed under statutory authority, and remain, even when under its control, subject to all the conditions imposed on them by statute; but, the Commission say, it obviously would be of advantage in a matter of so much importance to the general public, that the conditions under which amalgamation, of a more or less complete nature, takes place, should be examined and approved by some public authority. In connection with this "matter," the Commission state, "Mr. Edgar Speyer, who appeared before us as representing the firm interested in the financial arrangements of these railways, stated that, so far as his interests were concerned, he would have no hesitation in laying the whole case for an amalgamation before Parliament when the proper time came. Mr. Charles T. Yerkes, chairman of the Underground Electric Railways Co. of London, who has also lately succeeded Mr. R. W. Perks, M.P., as chairman of the Metropolitan District Railway Co., likewise informed us that he would be prepared to lay the whole scheme for amalgamation before Parliament and take a decision on the merits. Under these circumstances, we do not think it is necessary that we should say anything further on this subject in the present Report. We are satisfied that the formation of the Underground Electric Railways Co. of London has been of material assistance in raising the capital for works which will be of great public benefit."

The Commission next deal with the question of the regulation of traffic in the streets, and measures that should be taken to prevent or remedy obstructions in the streets; they propose to empower the Commissioners of Metropolitan and City Police to make regulations:—

To prevent the standing of vehicles at the sides of the streets, loading and unloading of goods, waiting of private vehicles, &c., and to fix the stopping places for omnibuses.

They also strongly recommend that the Commissioners of Police shall have power to keep slow traffic to the kerb.

"The vehicles that proceed at a walking pace through the streets of London include a large number of heavy vehicles transporting materials to and from factories and workshops, situated within, and adjoining, the central area. . . . . We are glad to learn that the changes in progress in modern industrial conditions are tending to their removal to less congested districts in the outskirts of London. The provision of cheap electrical power is a most potent factor, amongst others, in the direction of the decentralisation of manufactories, and we think that every facility, both legislative and municipal, should be given to that end. In this way London streets might be relieved of much of the heavy cartage traffic."

The Commission recommend the consolidation of the complex, widely scattered, and inadequate legislation that relates to the regulation of traffic, and say:—

"We are of opinion that, in the legislation which we recommend for the simplification and consolidation of the statutes regulating traffic in London, it should be provided that all regulations and by-laws relating to London traffic by whatsoever authority they may have been framed, should, in the interests of co-ordination, go before the proposed Traffic Board for examination and report, before final approval by the respective Departments of State having control over them, whether such Departments be the Board of Trade, the Local Government Board, or the Home Department."

The existing defects of the means of locomotion and transport in London are, in the opinion of the Commission, due mainly to the haphazard manner in which questions connected therewith have been treated in the past. The streets were not originally laid out on any general plan, nor were they made of sufficient width.

Railways of all classes have been practically left to private promoters, subject to such regulation as could be enforced by the intermittent control of Select Committees of Parliament.

While it is necessary that the provision of means of locomotion and transport should be carried out in accordance with a comprehensive plan, it is equally necessary that that plan should be modified from time to time to meet the changing requirements of the population, and make use of the last scientific inventions. Under these circumstances, the only effective remedy appears in the mind of the Commission to be the creation of a permanent authority, possessed of special knowledge and experience, and giving continuous attention to all questions affecting locomotion and transport in London.

The authority which the Commission recommend to be established should be a Traffic Board, and should discharge definite and practical duties. It should make a yearly report to Parliament on locomotion, transport and traffic in "Greater London," dealing with the whole subject, including such matters as the control of traffic, the regulation of the statutory powers of breaking up the streets for various purposes, the removal of any special obstructions to traffic, the provision of new lines of railway or tramway and calling attention to any errors or oversights in the maintenance of streets and roads on the part of local or street authorities. It would also deal with the question of street improvements, including street widenings and the construction of new streets, as well as the provision of alternative routes, and of facilities for dealing with cross traffic.

The most important function of the board would be the preliminary examination, before consideration by Parliament, of Bills seeking statutory powers for the construction or extension of works affecting the means of locomotion and transport in "Greater London."

The board would sit continuously, and Bills that required serious amendment could remain before the board until the necessary antecedent formalities were completed. The board would use its discretion as to suggesting amendments in Bills, in order to bring the particular proposals before it into harmony with any general scheme which might be approved for the provision of facilities for locomotion and transport in London. It would be at the option of the promoters of the Bill to accept or reject such suggestions. The board could also with advantage settle, subject to the approval of Parliament, all clauses for the protection of public or private interests. On completion of their inquiry, the board would pass on the Bill, with all amendments accepted by the promoters, to Parliament, accompanied by a report. The board would also deal with or report upon any questions which might be referred to them by a Select Committee of Parliament.

The board might also hear and determine all disputes relating to through running or the interchange of traffic on or between railways and tramways, or as to by-laws, whether between local authorities or private companies; and could perform a useful service by facilitating and suggesting amalgamation or joint working under suitable conditions, which its position as preliminary Examiner of Bills would afford it special facilities for so doing.

It will be seen that the functions of the board are of an advisory and semi-judicial character, and do not, as recommended for the present, involve the exercise of executive or legislative authority. What is required for such purposes, in the opinion of the Commission, is a small number of specially-qualified persons, selected solely on the ground of their competence, and holding office for a considerable period, subject always to good behaviour.

They suggest the board should consist of a chairman and not more than four nor less than two other members; and prefer that there should be not more than three members in all. No member of the board should engage in any business, or have any interests, which might conflict, or appear to conflict, with the proper discharge of his official duties; nor should he be a member of any local authority in London; or have any occupation which would limit the time which he could devote to the work of the board. What appears, they think, to be really essential is that the members of the board should be capable men of business, energetic, impartial, and able to devote if necessary their whole time to the work of the board.

"In conclusion," the Commission state, "they desire specially to represent the ability with which Mr. Lynden Macassey, M.A., B.Sc., LL.D., appointed by your Majesty to be Secretary of this Commission, discharged the very onerous duties of this office, for which he possessed special qualifications owing to his technical and legal knowledge of all questions connected with the problem of locomotion in London and its foreign cities. This knowledge has greatly facilitated our inquiry. We further desire to acknowledge the valuable services rendered by Mr. Angus Fraser Macrae, M.A., whom he appointed to be Assistant Secretary; by Mr. R. B. Dunwoody, Assoc.M.Inst.C.E., who carried out, to our complete satisfaction, the preparation of the numerous plans and diagrams which we required; as well as by the other members of the staff."

THE ULTRA-VIOLET MERCURY LAMP.

In a recent issue of the *Mitteilungen aus dem Glaswerk Schott und Ges., Jena*, Dr. Schott has published a description of this apparatus. Its essential feature is that the vessel containing the mercury vapour is constructed of a special glass pervious to ultra-violet rays, the lamp in question giving "light" of as short a wave-length as 253 $\mu\mu$. The ultra-violet lamp made by Heraeus, of Hanau, and exhibited at Breslau last year, emitted rays down to a wave-length of 220 $\mu\mu$, but, being constructed of quartz, it is too expensive a piece of apparatus to be employed for anything but scientific investigation.

The new lamp for ultra-violet light (which is known colloquially at Jena by the convenient contraction "uviol") consists of a tube from 8 to 30 mm. in diameter, and from 20 to 130 cm. long, made of the special transparent glass discovered by Dr. Zschimmer, and containing from 50 to 150 grammes of mercury. The length of the tube has to be considerable, not merely to hold the necessary quantity of mercury, but also to enable the lamp to be started, and to allow the negative pole to be constantly covered by the liquid, which is indispensable. In practice the length can be diminished either by bending the tube upon itself one or more times, or by arranging several shorter tubes electrically in series, even if disposed side by side or otherwise. The electrical connections are made by means of platinum wires fused into the glass, with carbon knobs inside as poles. The easiest way of bringing the lamp into action is by the Arons' process of inverting it momentarily. Hitherto the Hewitt plan of passing a current of high tension backwards through the lamp has not proved satisfactory.

The ultra-violet rays emitted by the lamp have not yet been thoroughly studied; but their presence may be recognised by the odour of ozone, by their power of discharging a negatively charged electroscope, and by their effect on the unprotected eye. As a result of numerous measurements with lamps of different sizes, it appears that under the best conditions a visible light of one Hefner unit is given by the consumption of 0·64 watt. The specific intensity of the visible light varies from 0·31 to 4·3 Hefner units per square centimetre (*i.e.*, from 1·75 to 24·3 British candle-power per sq. in.) of the longitudinal section of the lamp presented to the photometer. According to Pflüger and Ladenburg, the intensity of the ultra-violet light afforded by the Heraeus apparatus is about equal to, or rather weaker than, that of the visible light.

As regards the uses of the lamp, it has been found very serviceable for photography, either for negative making or for "printing." By employing two lamps, one arranged horizontally and the other vertically, excessively deep shadows are avoided. For this particular purpose it is advisable to construct the lamps of glass which does not transmit the light of shorter wave-lengths that tends to injure the eye. The apparatus has also been found useful for testing the degree of fugitiveness of new dyes and pigments. In the colour trade of Germany it is customary to send such new materials to more sunny latitudes in the south, as local climatic conditions are such that they cannot be properly tested within a reasonable period of time to see whether they resist sunlight to the necessary extent. No other artificial light, not even that of the arc, has hitherto been found to possess the fading power of sunlight. Experiments with the "Uviol lamp," however, show that the permanence of dyes can be estimated with its aid in a few days instead of months.

The light is very destructive to small insects. It kills a house-fly in one minute at a distance of 1·5 cm. where the warmth can have no effect. After a lamp had been burning during a summer night in a room with open window, thousands of nocturnal insects were found dead beneath it. The light also acts like the sun in destroying bacteria, but this matter is still under examination by Prof. Gärtner, of the Jena University.

In the direction of therapeutics the lamp has an advantage over the ordinary arc employed by Finsen, in the larger proportion of light with short wave-lengths which it gives, and in its smaller production of heat. Surfaces of skin up to 1,400 sq. cm. in area can be exposed simultaneously to a light of great intensity, and the heat emission is so small that the lamps can be approached to a distance of under 1 cm. When a lamp is allowed to act for from 5 to 15 minutes at a distance of from 1 to 3 cm. upon the healthy skin of *(e.g.)* an arm, no effect is noticeable at first. After a few hours a reddening appears which reaches a maximum in one day's time. Soon after, a slight burn is visible, the skin becomes irritable and peels in a few days, and in two or three weeks the red colour disappears, leaving a brown mark like that caused by prolonged exposure to the sun. Experiments are now in progress at the Jena hospital under the direction of Profs. Stintzing and Matthes upon the effect of the light upon skin diseases. Several mild cases of eczema of some years' standing have already been cured; more severe cases have been treated every day for some weeks to 15 or 30 minutes' exposure, and promise cure. A case of erysipelas has been cured almost without fever, but the treatment was so short that the influence of the lamp could not be appraised. An elderly, strong and well-nourished man and a young man of inferior physique were exposed for 20 or 25 minutes at a time to the light of four lamps developing 1,400 Hefner units, the treatment lasting for about 10 hours in all, spread over a period of three weeks. The reddening and browning already mentioned was noticed, but, except for some irritation of the skin, no evil effects were to be observed. Both men considered the exposure beneficial, and the younger man gained weight, acquiring a better appetite.

With care, a "Uviol" lamp will last for more than 1,000 burner-hours.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

8,890A. "Improvements in wireless telegraph transmitting apparatus." H. SHOEMAKER. (Date applied for under Patents Rule 9, April 27th, 1905.) July 11th. (Complete.)

8,890B. "Improvements in wireless telegraph receiving apparatus." H. SHOEMAKER. (Date applied for under Patents Rule 9, April 27th, 1905.) July 11th. (Complete.)

6,640A. "Improvements in and relating to electricity meters." C. W. J. BUSCH and H. ROOSEN. (Date applied for under Patents Rule 9, March 29th, 1905.) July 12th.

7,822A. "Improvements in and relating to controllers for electric motors." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) (Date applied for under Patents Rule 9, April 12th, 1905.) July 12th.

12,160A. "Electrolytic process for obtaining fixed gases from any suitable carburant." A. A. EVENO. (Date applied for under Patents Rule 9, June 10th, 1905.) July 12th.

14,146. "Improved means for controlling the trolley arms of electric tramcars." J. C. FERGUSSON and F. HITCH. July 10th.

14,167. "An improved method of making resistances specially adapted for use in connection with electrically-heated curling tongs and such like." J. MACLEAN. July 10th.

14,208. "Improved electrical switch apparatus for supplying current-consuming devices on several motor-cars of electrically-propelled trains." SIEMENS BROS. & CO., LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 10th. (Complete.)

14,209. "Improvements in apparatus for supplying electrical energy to a network by the aid of an auxiliary-current generator and an auxiliary line wire." SIEMENS BROS. & CO., LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 10th. (Complete.)

14,211. "Starting apparatus with controller drum for induction motors." SIEMENS-SCHUCKERT-WERKE, G.m.b.H. (Date applied for under Patents Act, 1901, August 3rd, 1904, being date of application in Germany.) July 10th. (Complete.)

14,214. "Improvements in electric furnaces." F. A. KJELLIN. (Date applied for under Patents Act, 1901, July 11th, 1904, being date of application in Switzerland.) July 10th. (Complete.)

14,221. "Improvements in means for producing current or radiations for a transportable wireless transmitter station." W. P. THOMPSON. (Gesellschaft für drahtlose Telegraphie, G.m.b.H., Germany.) July 10th. (Complete.)

14,222. "Improvements relating to the suspension of electric motors of locomotives." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 10th. (Complete.)

14,256. "Electric heating cartridges." A. VOELKER. July 11th.

14,293. "Improvements in electrical heating apparatus." C. MCINTYRE and A. U. ALCOCK. July 11th.

14,297. "Improvements in surface contact electric traction systems." E. A. MITCHELL and THE DOLTER ELECTRIC TRACTION, LTD. July 11th.

14,314. "Improvements in or relating to microphone apparatus for telephone and other circuits." Q. MAJORANA. July 11th. (Complete.)

14,317. "Improvements in polyphase commutating machines." THE ELEKTRIZITATS ACT.-GES., vormals W. LAHMEYER & Co. (Date applied for under Patents Act, 1901, July 11th, 1904, being date of application in Germany.) July 11th. (Complete.)

14,318. "Improvements in and relating to electric ignition gear for explosion motors." G. CORNILLEAU and A. SAINTE-BEUVE. (Date applied for under Patents Acts, 1901, December 29th, 1904, being date of application in France,) July 11th. (Complete.)

14,320. "Improvements in single-phase alternating-current motors." SIEMENS-SCHUCKERT-WERKE, G.m.b.H. (Date applied for under Patents Act, 1901, December 19th, 1904, being date of application in Germany.) July 11th. (Complete.)

14,323. "Electrical igniting device for explosion engines." S. BULLOCK and A. R. BULLOCK. July 11th. (Complete.)

14,333. "Improvements in electric furnaces." P. GIROD. July 11th. (Complete.)

14,345. "Improvements in or relating to electric switches for use in connection with motor-controllers, and for analogous purposes." THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., ROBERT F. HALL and J. R. GARNER. July 12th.

14,366. "Improvements in electric sparking plugs for internal combustion engine ignition." R. KENNEDY. July 12th.

14,400. "Improvements in the manufacture of electrical resistances." C. RUZICKA. July 12th.

14,401. "Improvements in alternate-current induction motors." L. J. HUNT and THE SANDYCROFT FOUNDRY CO., LTD. July 12th.

14,417. "Improvements in and relating to electrical connections for accumulators, induction coils, sparking devices and the like." W. GARD. July 12th.

14,420. "Improvements in electrically-operated cranes, hauling gear and similar appliances." G. R. HINGELBERG, D. G. JONES, F. L. BERRY and E. MIDDLETON. July 12th.

14,441. "Improved means for suspending and sustaining electric lamps and the like at any desired height." W. WHITAKER, JUN. (Date applied for under Patents Act, 1901, July 14th, 1904, being date of application in United States.) July 13th. (Complete.)

14,457. "Improvements in and connected with electro-magnetic annunciators acting simultaneously as choking coils." H. OPPENHEIMER. (Akt.-Ges., Mix and Genest, Germany.) July 13th.

14,461. "Improvements in electric organ actions." H. C. E. JACOBY. July 13th.

14,465. "Improvements in automatic cut-outs or switching devices for electrical indicating means." G. HARRISON. (The Electric Railway Improvement Co., United States.) July 13th. (Complete.)

14,466. "Improved electric apparatus for interlocking electric signals and points." E. M. T. BODDAM. July 13th.

14,467. "Improvements relating to electrotype plates." I. T. NELSON and J. MURRAY. July 13th.

14,471. "Improvements relating to switching devices for use in electric flash advertising." L. K. JOB. July 13th.

14,483. "Improvements in automatic electric switches." J. J. COACHMAN. July 13th.

14,490. "Improvements in and relating to electric switches." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) July 13th.

14,491. "Improvements in incandescent electric lamps and methods of making the same." THE BRITISH THOMSON-HOUSTON CO., LTD. (The General Electric Co., United States.) (Complete.) July 13th.

14,496. "Improvements in electrolytic or liquid resistance apparatus for electric regulators, electric motor-starters, or the like." H. HIRST and C. S. M. MEDLEN. July 14th.

14,511. "Improvements in electricity meters." S. H. HOLDEN and CHAMBERLAIN & HOOKHAM, LTD. July 14th.

14,518. "An improved system of electric ignition, for gas or petrol engines and the like." W. S. FROST. July 14th.

14,526. "Improvements in arc lamps." B. M. DRAKE. July 14th.

14,559. "Improvements in or relating to electric alternating current switches." C. W. S. CRAWLEY. July 14th.

14,565. "Improvements in devices for protecting electric distribution systems and apparatus against reversal of energy." THE BRITISH THOMSON-HOUSTON CO., LTD., and J. E. WOODBRIDGE. July 14th.

14,566. "Improvements in and relating to electric circuit-interrupting devices." THE BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. July 14th.

14,567. "Improvements in methods of regulating alternating current dynamo-electric machines." THE ALLGEMEINE ELECTRICITATS-GES. (Date applied for under Patents Act, 1901. July 15th, 1904, being date of application in Germany.) July 14th. (Complete.)

14,582. "Improvements in or relating to low-tension electric ignition mechanism for internal combustion motors." J. S. CRITCHLEY. July 15th.

14,612. "Improvements in apparatus for use in combination with electric stop motions as used on drawing, slubbing and other similar machines for preparing and spinning cotton and other fibrous materials." T. CHADWICK. July 15th.

14,614. "Improved electric stop motion for drawing, slubbing and intermediate frames." T. SCHOFIELD. July 15th.

14,615. "Improvements in and relating to electric arc lamps." CROMPTON AND CO., LTD., and A. J. HODGSON. July 15th.

14,630. "Improvements in controllers for electrically-propelled vehicles." J. S. RAWORTH. July 15th.

PUBLISHED SPECIFICATIONS.

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1904.

ELECTRIC CURRENT GOVERNORS OR ELECTRO-MAGNETIC SWITCHES. A. J. Boult. (W. J. Richards, United States.) 28,393. December 27th.

ELECTRIC SWITCHES. R. Longden. 29,014. December 26th.

PENDANT ELECTRIC FIXTURES H. H. Lake. (W. S. Bradshaw, A. Keough, M. Keough and J. Keough, U.S.A.) 29,401. December 31st.

ELECTRICAL SIGNALLING APPARATUS F. S. Stohnes. (Date applied for under International Convention, March 19th, 19 4) 29,532. December 31st.

ALTERNATING CURRENT MOTORS. A. P. Zani. 8,227. April 9th.

ALTERNATING CURRENT ELECTRIC MOTORS. The British Thomson-Houston Co. (General Electric Co., U.S.A.) 10,457. May 6th.

ENCLOSED FUSES FOR ELECTRICAL INSTALLATIONS. W. Fellenberg. 10,556. May 9th.

MOTOR VEHICLE FOR AGRICULTURAL PURPOSES, APPLICABLE ALSO FOR EXTINGUISHING FIRES, WATERING GARDENS, GENERATING ELECTRIC LIGHT, AND OTHER PURPOSES. A. Fröde. 10,711. May 10th.

REVERSE CURRENT ELECTRIC CIRCUIT BREAKERS. L. Andrews. 10,722. May 10th.

ELECTROLYTIC APPARATUS. H. S. Blackmore and E. A. Byrnes. 10,794. May 10th.

ELECTRIC ACCUMULATOR ELECTRODES OR PLATES. A. Ricks. 11,288. May 17th.

PROCESS FOR OBTAINING PRODUCER GAS AND ELECTRICAL ENERGY FROM PEAT. F. T. Warburton. 11,917. May 25th.

HIGH TENSION ELECTRIC SWITCHES. The British Thomson-Houston Co. (Allgemeine Elektricitäts.-Ges., Germany.) 12,383. May 31st.

COMBINED ELECTRIC LAMP-HOLDER AND CANDLE NOZZLE. E. O. H. Tiffin. 12,607. June 3rd.

CONTINUOUS CURRENT ELECTRIC MOTORS AND GENERATORS. L. Torda. 13,264. June 11th.

SIGNALS IN TELEPHONIC EXCHANGE. H. Oppenheimer. (Actiengesellschaft Mix and Genest, Germany.) 13,643. June 16th.

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co., U.S.A.) 15,118. July 6th.

ELECTRIC LIGHT FITTINGS. J. G. Irving. 15,267. July 8th.

SYSTEMS OF ELECTRICAL DISTRIBUTION AND APPARATUS THEREFOR. S. Ferguson. 15,634. (Date applied for under International Convention, July 13th, 1903.) July 13th.

SPACE TELEGRAPHY. J. S. Stone. 25,641. (Date applied for under International Convention, April 28th, 1904.) November 24th.

METERS FOR THREE-PHASE ALTERNATING ELECTRIC CIRCUITS. The Union Elektricitäts-Gesellschaft. (Date applied for under International Convention, May 15th, 1903.) 11,283. May 16th.

ELECTRICALLY-PROPELLED VEHICLES. R. Thayer. 11,264. May 16th.

ALTERNATING CURRENT DISTRIBUTING SYSTEMS. C. H. Merz. 11,364. May 17th.

SWITCHES. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.) 11,448. May 18th.

SWITCHES. F. M. Green and G. Hallam. 11,720. May 21st.

SWITCH AND CIRCUIT BREAKERS. British Thomson-Houston Co., Ltd., and A. S. Cubitt. 12,245. May 30th.

PRODUCING ELECTROTYPES. S. Cowper-Coles & Co., and S. Cowper-Coles. 13,012. June 8th.

MEASURING AND INDICATING DEVICES. G. Hughes. 13,527. June 15th.

PROTECTING ELECTRIC APPARATUS AGAINST REVERSAL OF ENERGY FLOW. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.) 14,741. June 30th.

SLIDING APPARATUS FOR RAISING OR LOWERING ELECTROLIERS. J. W. Lea and J. H. Perrins. 15,332. July 9th.

DYNAMO-ELECTRIC MACHINES FOR HAND WORKING. J. L. B. Meusch and O. Siegert. 15,517. July 12th.

METERS. W. M. Mordey and G. C. Fricker. 15,704. July 14th.

BOXES, COVERS OR CONTAINING CASES FOR ELECTRIC SWITCHES, FUSES AND THE LIKE. T. H. Marsh and A. B. Mudie. 15,770. July 15th.

GAS ELECTRIC LAMP AND ARC LAMPS. H. Beck. (Date applied for under International Convention, June 24th, 1903.) 16,242. July 22nd.

AUTOMATIC ELECTRIC CUT-OUT SWITCH. E. J. Javaux. 16,393. July 25th.

ELECTRICALLY-DRIVEN WINDING ENGINES. A. Raky. 16,418. July 25th.

ARC LAMPS. A. D. Jones and the Jandus Arc Lamp & Electric Co. 16,603. July 28th.

SWITCHES FOR REVERSING THE CURRENT IN ELECTRIC MOTORS. G. H. Whittingham. (Date applied for under International Convention, October 29th, 1903.) 23,084. October 26th.

ARC LAMPS. J. D. F. Andrews and The Manufacturing Electric Co., Ltd. 4,937. February 28th.

ELECTRIC AND AUTOMATIC WORKING SIGNALS. D. M. Daboo. 5,064. March 1st.

ELECTRIC ALARMS. J. Kiewert. 5,204. March 3rd.

GEAR FOR CONTROLLING LIFTS AND HOISTS. J. Björnstad. 5,374. March 4th.

LIFTS. J. Bush. 6,690. March 19th.

MOVING THE POINTS ON ELECTRIC TRAMWAYS AND RAILWAYS. J. P. Tierney and J. Malone. 7,428. March 29th.

TELEPHONIC COMMUNICATIONS. J. H. Lee. 7,676. March 31st.

WORKING OF SINGLE LINES OF RAILWAY ON THE ELECTRIC STAFF OR OTHER ELECTRIC SYSTEMS. C. M. Jawbs. 8,064. April 7th.

SWITCHES AND CIRCUIT BREAKERS. W. G. Haywood and S. G. Brounger. 8,922. April 19th.

STARTING DEVICES FOR MOTORS. British Thomson-Houston Co., Ltd. (General Electric Co.) 9,660. April 27th.

COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co., Ltd. (General Electric Co.) 9,841. April 29th.

RESISTANCE UNITS AND METHODS OF MAKING SAME. British Thomson-Houston Co., Ltd. (General Electric Co.) 9,842. April 29th.

VAPOUR ELECTRIC APPARATUS. British Thomson-Houston Co., Ltd. (General Electric Co.) 9,844. April 29th.

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co., Ltd. (General Electric Co.) 10,019. May 2nd.

DYNAMO-ELECTRIC MACHINES. L. Wilson. (Date applied for under Patents Act, 1901, June 1st, 1903, being date of application in U.S.A.) 11,604. May 20th.

VAPOUR ELECTRIC APPARATUS FOR RECTIFYING ALTERNATING ELECTRIC CURRENTS. M. von Recklinghausen. 11,832. May 24th.

LINING AND INSULATING OF CHAMBERS OR CASES CARRYING SWITCHES OR FUSES OR BOTH. J. H. Ward and M. H. Goldstone. 12,076. May 27th.

INTERCOMMUNICATION TELEPHONE SYSTEMS. I. N. Birnbaum and H. G. White. 21,995. October 12th.

CONTROLLERS FOR ELECTRIC MOTORS. P. M. Justice. (The Voltage Controllers Co., U.S.) 22,326. October 17th.

SWITCHES. W. M. Scott. 23,001. October 25th.

FIRE ALARMS. W. B. Hopkinson. (Date applied for under Patents Act, 1901 April 15th, 1904.) 23,182. October 27th.

SPARK GAP APPARATUS FOR USE WITH HIGH FREQUENCY CURRENTS, PARTICULARLY ADAPTED FOR THERAPEUTIC WORK. H. H. Lake. (The Electro-Radiation Co., United States.) 25,378. November 22nd.

ROTARY SPARK-GAP APPARATUS FOR USE WITH HIGH FREQUENCY CURRENTS. H. H. Lake. (The Electro-Radiation Co., United States.) 25,382. November 22nd.

CURRENT CONTROLLING SYSTEMS. A. C. Eastwood. 26,098. (Date applied for under International Convention, June 4th, 1904.) November 30th.

ARC LAMP ELECTRODES. C. P. Steinmetz. 26,917. December 9th.

EXTINGUISHING GAS LAMPS BY ELECTRICITY. G. Giorgi. 27,297. December 14th.

METHOD OF WINDING FOR ASYNCHRONOUS ELECTRICAL MACHINES FOR PRODUCING A VARIABLE NUMBER OF POLES IN THE PROPORTION OF 1 : 2. Siemens-Schuckert-Werke Ges. Mit. bes. Haft. 27,702. (Date applied for under International Convention, February 13th, 1904.) December 19th.

ELECTRIC PERCUSSIVE TOOLS. P. A. Newton. (The American Inventions Co., United States.) 27,842. December 20th.

INCANDESCENT ELECTRIC LAMPS. F. W. Howorth. (J. H. Guest and C. I. Hills, United States.) 28,458. December 27th.

ELECTRIC LIGHTING ARRANGEMENTS FOR INTERNAL COMBUSTION ENGINES. L. Renault. 28,824. (Date applied for under Patents Act, 1901, February 2nd, 1904, being date of application in France.) December 29th.

SPACE TELEGRAPHY. J. S. Stone. 29,142. (Date applied for under Patents Act, 1901, February, 1904, being date of application in United States.) December 30th.

SPACE TELEGRAPHIC RECEIVING SYSTEMS. J. S. Stone. 29,143. (Date applied for under Patents Act, 1901, February, 1904, being date of application in United States.) December 30th.